THE IRON TRADE REVIEW

New Jersey Steel and Iron Co

VOLUME XXVI. CLEVELAND, O. FEBRUARY 2, 1893. CHICAGO, ILL. NUMBER 5.

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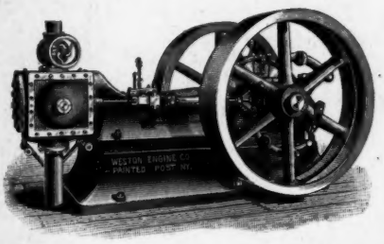

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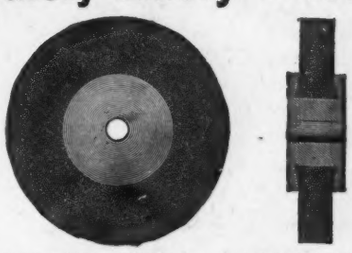

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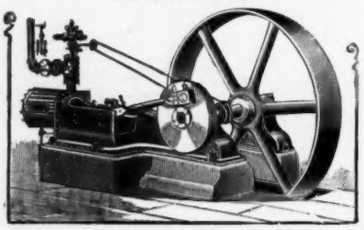

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THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. FEBRUARY 2, 1893. CHICAGO, ILL. NUMBER 5.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

Though prices in some departments of the iron market, as reported last week, were the lowest on record, those reported from some of the leading selling centers this week are still lower. Sellers have been forcing matters and prices have broken. Yet, low as the figures have been, the volume of transactions is not heavy; had it been so, there would hardly have been the weakening in prices that has been noted, for stocks were so low in buyers' hands that a fairly strong consumptive demand would have checked cutting. From Detroit and Chicago come reports of close competition between Northern and Southern coke irons, with the result that buyers contracted, though only for moderate amounts, on the most favorable terms yet noted. That low prices are made on deliveries covering a year indicates the abandonment of any hope of an early return to the 25-cent advance made by Southern firms last fall. In finished material there have been some surprisingly low quotations and the competition between mills is keener than ever. Eastern concerns, in the scarcity of orders there, have been invading the Western market and getting a share of the business in some cases, but only on a basis barely covering cost. The saving feature of the situation is a picking up in inquiries, and an indication that heavy buying is ahead in lines requiring large amounts of structural steel.

THE CLEVELAND OUTLOOK.

An average forecast of the year in Cleveland iron ore circles would contain a memorandum for latter January, and early February, running substantially, "About this time look out for ore sales." It is in view of such expectations that it is quite as important to state week by week, that there have been no ore sales, if that be the case, as to chronicle sales, where there have been any. For the week under review, it is to be said again, that no sales of '93 ore have yet been made. Since the opening of the year matters have not gone with furnacemen who are buyers of Lake Superior ores, in a way to cause any haste in contracting for a year's supply of ore. The situation needs to clarify, in raw iron and finished iron markets, before ore contracts will be thought of. The question of freights, while of no present interest, because ore firms will have no immediate need to quote prices, will, of course, be an important factor in the situation, when contracts come to be made. Vesselmen are firm, for the present, in the position that $1.20 Ashland should be the basis of season charters. Ore firms will be in no mood, however, to cover largely on any sales that may be made, at a figure so close to the season charters of last year, when ore sold from 35 to 50 cents more than can be secured now. Items of interest to the ore trade, announced in the week, are the dissolution of the firm of Runyon, Mack & Co., announced elsewhere, and the transfer to Corrigan, Ives & Co., of the selling agency for the Florence and Iron River, Eagle and Corbett mines, all producers of non-Bessemers. Furnace tests at West Duluth, within the week, in which all-Mesabi ores were used, have been satisfactory. The first run was made from Cincinnati ore and gave the same result noted at Pittsburg, where the Mesabi ore was used in a mixture, viz., none of the blowing out that was feared, and none of the packing in the furnace, the metal running freely.

Pig Iron. The market is weaker than it was a week ago—a thing regarded as almost impossible by furnacemen then. Valley makers of pig iron have had offers made them in the past fortnight that would have been regarded ridiculous two months ago. That is the view many furnacemen take of them now, for there are those in the valleys who do not want to talk with a buyer of Bessemer who is notwilling to pay $13 at valley furnaces, and who will quit producing before they will accept current prices. Yet others are selling their product and realizing bare cost, sometimes less. There have been sales of several thousand tons in the valleys within the week on a basis of $13.10 and $13.20 Pittsburg, or 60 cents less at furnace. Grey forge that had been holding firm at $11.65 Valley furnace, or $12.25 Pittsburg and Cleveland, has gone off a trifle from that figure in the last few days, as a valley transaction of several thousand tons indicates. The outlook is certainly not encouraging; the only shade of improvement is in the larger inquiry. The Erie Car Works failure is felt by one Valley concern, but that is the extent of its influence in this market. Interesting in its effect on coke competition, is the news of the acquisition by W. J. Rainey, of the Mt. Braddock Coke Works, with 170 ovens and 500 acres of coal, beside 500 acres of coal land adjoining, bought from other parties. This gives Mr. Rainey 1,600 ovens in the Connellsville district and 5,000 acres of land.

Finished Iron, etc. No improvement in prices can be noted, but there is a better inquiry and, for the later future, prospects of good demand, particularly in structural lines. There has been a fair demand for bar iron, chiefly from car-building concerns, while agricultural implement makers have been in the market for material outside of their advance contracts. Beams and channels and plates and angles are quoted at $2 a ton below December prices. The Pottstown Iron Co., whose failure is noted elsewhere, has been conspicuous in the cutting recently done on construction contracts, in districts tributary to Cleveland. Old material is dull; no large contracts are reported. The custom of placing large contracts with deliveries extending over the year is less common, and purchasers are content to take the run of the market. Old iron rails are $19, and there is a falling off of 50 cents a ton in several varieties of scrap.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

While a fair tonnage was closed last week, it was mostly done in small lots up to 200 and 300 tons, only one large transaction being reported. Buyers are still holding off, purchasing only in such quantities as will meet their immediate needs, and they seem to do this in the belief that the future will show a general lowering of prices. Furnacemen, on the contrary, continue to say that prices are now at the bottom notch, and will go no lower. Quotations are being cut, it is claimed, on both Northern and Southern coke, and consequently prices are weakened. Lake Superior charcoal has had a fairly good sale, though nothing large is reported. Quotations are a trifle unsteady, sales having been reported at $16.50.

BAR IRON.—Inquiries still continue to be on the increase, though sales are quiet. Quotations are unchanged at 1.45c Valley mills, and are quite firm at that.

BILLETS AND RODS.—Little business has been done, and there is no change in prices. Billets, $24; rods, $32.50.

RAILS AND TRACK SUPPLIES.—Nothing has transpired in this market, and prices are unchanged. Rails, $30 to $32, according to specifications; track bolts, 2.65c to 2.70c; spikes, 2.05c to 2.10c.

STRUCTURAL IRON.—A fair demand is noted for structural shapes, with numerous inquiries for future business. Prices are unchanged: Beams and channels, 2.25c to 2.50c; angles, 2.05c to 2.15c; sheared plates, 2.10c to 2.20c; tees, 2.40c to 2.50c.

PLATES, TUBES, ETC.—There is no change to report, either in prices, or the situation. The mills are fairly busy, and orders continue to come in at a fair rate. Tank plates, 2c to 2.10c; shell steel, 2.30c to 2.40c; fire box steel, 3.75c to 4c; flange steel, 2.55c to 2.65c; tubes, discount 62½ per cent.

SHEETS.—The demand for black sheets is fairly good, and quotations are the same as last week—2.85c. Galvanized sheets are being sold to finish orders at the last quotations—70 and 7½ per cent. at the mills, and 65 and 10 per cent. to 70 per cent. from store.

MERCHANT STEEL.—Business is fair, with unchanged prices: Open hearth spring, 2.35c to 2.40; tire, 2c to 2.15c; machinery, 2.20c to 2.25c; crucible spring, 3.60c; machinery, 4.75c; tool steel, 6½c and upwards; Bessemer bars, 1.80c to 1.90c.

OLD RAILS, SCRAP, ETC.—Very little business has been done, and the outlook is rather discouraging. Prices are: Old rails $18.50; old wheels, $14; old steel rails, $11 to $15; No. 1 forge, $14; No. 1 mill, $9; turnings, $7.50; mixed steel, $9; coil steel, $12; leaf steel, $14; low tires, $14.00.

GENERAL MARKET RESUME.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The market has developed no evidences of greater strength in the week just ended. Mill and foundry irons have about held their own, prices on the latter being shaded, perhaps, while mill iron is still in light demand at $12.25, the ruling figure of a week ago. The decline in Bessemer has gone no further, possibly because it could not. Offers of $13.20 were refused in a number of instances, though rumors were current of one or two transactions at lower prices. The market may be fairly quoted to-day at $13.25. Two or three transactions involving an aggregate of 5,000 tons have been made at this figure in the past three days. The billet market is without feature; makers for the most part insist that $21.50 is bottom, but buyers quote $21.25, that being the Pittsburg basis of sales said to have been made in the Wheeling district. Makers do not look for the recent slump in Bessemer to affect the billet market to any extent, as the influences surrounding the Bessemer iron market are special; though not thoroughly understood, they are evidently speculative, in a measure. Muck bar is quiet at $24.25@$24.35; scrap dull; rails unchanged, with some slight new demand.

Cincinnati. There have been no striking features to the iron market since our last report. The volume of business, while not large, has been growing gradually. Some quite large contracts with pipe works and other consumers have been closed, mainly for deliveries running forward several months. There has also been a steady run of small carload orders. Beyond this the mood of buyers is still a waiting one. Prices have not varied much from those ruling at the opening of the year. They have shaded off 25 cents per ton from those of November and December, and transactions have been reported at figures very close to the minimum of last summer. The general business situation is not yet clearly enough defined to enable iron men to forecast intelligently the year before them. Two or three weeks of extremely unfavorable weather have retarded operations in nearly all manufacturing lines and thrown things out of proper balance. The situation, however, is slightly improved, and prospects on the whole favor a good business year.

St. Louis. More activity is noticeable in the local market this week. One order of 1,000 tons foundry iron was placed since our last report, and another of about 500 tons. Several of the Southern furnaces that have a large accumulation of certain grades of iron are making a slight concession on large orders for early delivery, although on extended deliveries there has been no change in prices.

Detroit. Beyond the placing of the large orders mentioned in this report, a week ago, which were almost exclusively for Southern iron, little or nothing has occurred in the iron market of any interest here. The placing of these large orders, aggregating several thousand tons, developed a weakness on Southern grades that was somewhat surprising. It would seem that Southern furnaces are not feeling very hopeful when they are willing to contract at slightly cut figures on present quotations and make delivery covering twelve months. Unfortunate as such a result would be for the interests involved, it may be that the old fight between Northern and Southern furnaces is to be renewed with extreme vigor, and it would seem as if both sections of the country would emerge from the contest considerably shattered. There have been some small inquiries for Lake Superior charcoal, and the usual amount of carload and small orders, but positively nothing else of any interest in the market.

Buffalo. Inquiry for Lake Superior charcoal iron has been on a more liberal scale. Foundry irons for forward delivery continue in good demand. Shipments are light, however, and prices weak. The impression among buyers that prices will remain about as at present through the year to a certain extent curtails buying.

A MEETING held at Chicago last week by manufacturers of house heating boilers, to perfect the U. S. Steam and Hot Water Boiler Association, decided, instead, to dissolve it. Three of the companies, the Pierce, Butler & Pierce Mfg. Co., of Syracuse; the Richardson & Boynton Co., of New York, and the National Hot Water Heater Co., of New York, announced that they had joined the American Boiler Co. and that organization refused to join the proposed combine on the ground that the trust laws of Illinois prevented. The American Boiler Co. has a capital of $1,500,000 and has purchased the three plants it includes. There is talk of further purchases.

THE IRON TRADE REVIEW

DEVOTED TO

IRON ORE, IRON AND STEEL MANUFACTURE, MACHINERY TRANSPORTATION, INDUSTRIAL PROGRESS, STATISTICAL INFORMATION, ETC.

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FEBRUARY 2, 1893.

MESABI OUTPUT AND ORE PRICES FOR '93.

While there has been a great deal of general statement as to the depressing effect Mesabi ores will exert upon prices, this year, there has been nothing more specific than the frequent citation of the 1,500,000 tons minimum first year output, provided for in leases thus far made, and the statement that ores from three or four Mesabi range mines had been contracted for by the Minnesota Furnace Co. at $2 a ton delivered at West Duluth furnace stock house. These assertions have done no little harm to Mesabi interests and to those of competing ranges. Men who have put their capital into these new developments are realizing, as they come face to face with buyers of ore, that many things have been said about the cheapness of production on the Mesabi, that if true, had been better left unsaid, for good business reasons; and as developmental work proceeds further, the more apparent does it become that in some of these reports the element of accuracy is substantially lacking.

It has been stated in these columns, on several occasions, that the guaranteed minimum outputs published in connection with Mesabi leases are much more flexible than appears on the face of them; and prominent pioneers on the range have already lowered the minimum tonnage on which royalty must be paid in 1893 by 50 per cent., with the understanding that this 50 per cent. will be cut in twain, if necessary. There is no such deduction to be drawn from these contracts, as has been made in some published statements, namely, that 1,500,000 tons of Mesabi ore will come up in the market this year, whether or no, and thus create a surplus that will push prices down, even to cost, in some instances. Mr. Lon Merritt's statement to this paper that the transportation possibilities of lines reaching the new range would put the amount of Mesabi ore likely to come upon the market in '93 somewhere between 300,000 and 500,000 tons, should be accepted as some index of the feeling of Mesabi fee owners on the subject of reducing guarantees of minimum outputs.

The statement that Mesabi ores had been sold under contract to the Minnesota Furnace Co., to be delivered at the company's West Duluth blast furnace at $2 a ton, has been given circulation by Eastern journals. Vice-president Barbour, of the Standard Ore Co., has written correcting this statement, saying that the price was $2 f. o. b. mine. Yet the story reappears in an Eastern journal devoted to mining interests, with the addition that the Ironton Structural Steel Co., of Duluth, has "made arrangements to put in one 175-ton coke furnace which will run on Mesabi ores, delivered at stockhouse at $2 ton, on a 62 per cent. guaranty." To "put in" a 175-ton coke furnace is a project of some magnitude, involving a considerable outlay of money, and ordinarily requiring many months for its execution. It is hardly presumable that ores scarcely tested in any furnace, would be bought for a furnace which a company was only planning to "put in," before any material had been bought for the furnace itself.

To know what $2 f. o. b. Mesabi mine would mean on Lake Erie docks, we have only to add 80 cents railroad freight to the head of Lake Superior and $1.25 lake freight. This would give $4.05 in the Cleveland market, which is very close to the basis on which sales of standard soft Bessemers have been made since the close of navigation.

There are not a few producers on other ranges that could compete with Mesabi ores at $4.05 Cleveland and still make a profit—a smaller one, certainly, than they have made in the last few years, but, nevertheless, a profit, as iron profits go, in these days. We say nothing here, be it understood, of quality, or comparative desirability, or of the value of an approved furnace record of years, or of ease of handling by furnacemen, by reason of long continued use in a given mixture. We simply make the point that the market developments thus far, of Mesabi ores, do not indicate such a slump in ore prices as has been contemplated by some of the published statements.

Actual contracts, when they are made, between furnacemen and ore men, will demonstrate just how much of a "bear" movement these Mesabi generalities have occasioned. Furnace men may be depended upon to "shop around" before they make their contracts, and ore men will be just as sure to know, to a close approximation, how far below last year's prices the introduction of the new producer, together with the competition of unsold '92 ores, will force them to go. Under these circumstances, some of the current statements about Mesabi output and prices smack too much of stock exchange methods to be dignified as they have been. It needs to be remembered that while newspapers may reflect the iron market with greater or less accuracy, they cannot make it.

SOUTHERN ADVANCE IN IRON AND STEEL.

Dr. Wm. M. Sweet, in a Census Bulletin just issued, gives an interesting body of statistical matter and comment on the iron and steel industries of the South. He refers to Southern activity in the building of coke blast furnaces as a conspicuous feature of the development of iron and steel making in the United States, in the decade ending with 1890, and points this general statement with a table showing capital invested, labor and wages, cost of materials and value of products, for three census years—1870, 1880 and 1890. The table follows:

	1890.	1880.	1870.
No. establishments	92	121	91
Capital invested	$33,207,370	$6,964,207	$7,897,325
Av. No. hands employed	*7,932	9,486	5,488
Wages paid	*$2,917,158	$2,186,855	$1,668,160
Cost of materials	15,410,982	4,452,864	3,562,955
Value of products	22,494,870	7,769,050	7,008,137

* Excludes officers or firm members, clerks or salesmen and their salaries.

The same difficulty appears with the figures above given that has been noticeable in other comparisons made between the 1890 and the 1880 census returns—the totals put under a given designation do not represent precisely

the same items for both years. Thus we are told that the data for 1880 represent not only the operation of blast furnaces, but also the capital invested, hands employed and wages paid in other branches of industry operated in direct connection with these works. This explanation serves to show a much greater blast furnace development in the past 10 years than the figures would indicate; and this the bulletin before us conveys by setting down in a separate table the amount of capital invested in blast furnace buildings, machinery, tools, etc. This amount was $22,592,812 in 1890, as against $6,016,941 in 1880, an increase of more than 260 per cent.

The total of all iron and steel making establishments in the South, in 1890, was 145. In 1880 it was 218, and in 1870, 175. The decrease in blast furnaces, in the 10 years preceding 1890, was from 121 to 92; in forges and bloomaries, from 49 to 4; while rolling mills and steel works increased from 48 to 49. The decrease in the number of blast furnaces came through the abandonment of a large number of charcoal furnaces of small size and poor situation, and the consolidation under one management of establishments that have since been reported as one. The decrease in forges and bloomaries is due to the abandonment of establishments producing pig and scrap blooms, and blooms and bar iron direct from the ore. Their aggregate output was small, and one by one they have gone out, so that to-day the manufacture of bar iron direct from the ore by the old-fashioned Catalan process is practically an extinct industry in the South.

The rolling mill and steel working statistics are interesting, next to those for blast furnaces. They are summarized as follows:

	1890.	1880.	1870.
No. of establishments	49	48	71
Capital invested	$17,528,096	$11,665,260	$5,104,510
Av. No. of hands employed	*10,696	10,615	5,425
Wages paid	*$4,677,185	$3,964,612	$3,100,000
Cost of materials	13,036,029	10,252,098	7,602,346
Value of products	19,920,952	17,062,587	14,108,071

* Excludes officers or firm members, clerks or salesmen and their salaries.

The *Iron Age* makes the point, and with good reason, that the geographical basis of Dr Sweet's statistics is at fault. He makes the iron producing Southern States consist of Alabama, Delaware, Georgia, Kentucky, Maryland, North Carolina, Tennessee, Texas, Virginia and West Virginia. The criticism of our New York contemporary is that the Wheeling district, which, in finished iron and steel, is the same as West Virginia, is never thought of by anyone in the iron trade as part of the South, since it draws for all its supplies upon the same sources as the Pittsburg district and the Valleys, and has the same markets. It makes the same point regarding Delaware, whose mills at Wilmington are naturally classed with those a few miles further up the river, at Chester and Philadelphia.

Taking out Delaware and Virginia, the value of Southern iron and steel works products in 1890 would be $29,425,287, instead of $42,590,822, as Dr. Sweet's statistics make it; and in 1880, $16,951,942, instead of $25,353,251. The increase thus appears to be $12,473,345, instead of $17,237,571. The production, according to Dr. Sweet's tables is distributed as follows:

	1890. Net tons.	1880. Net tons.
Iron	266,850	287,229
Bessemer steel	241,745	.....
Open-hearth steel	6,050	3,020
Crucible steel	1,130	75
Total	515,775	290,324

West Virginia and Delaware have first and second place respectively, as producers. Taking them out of the Southern column, we have these figures, according to the *Iron Age*, for the Southern rolling mill industry in 1890 and 1880:

	1890.	1880.
Number of establishments	32	31
Capital invested	$9,554,552	$7,843,600
Number employed	5,713	6,520
Wages paid	$2,359,438	$2,318,478
Cost of materials	7,969,224	13,522,523
Product, net tons	154,391	188,894

The 1890 figures for product are not exact as far as Kentucky and Maryland are concerned, the product of former State being put with that of West Virginia to make a total, in the American Iron and Steel Association report, and those for Maryland put with Delaware's to make a total; but the West Virginia and Delaware products have been closely estimated and subtracted for the above.

It has been the custom of Southern journals to refer to their rolling mill industry, either as declining, or as failing to make an advance. Reference is had, in such statements, to this industry in the States generally regarded as the iron-producing South—States that make iron from ores and fuel within their own borders; States that have practically built up their own iron industry in the last 20 or 25 years. In this view the figures given above, prepared by the *Iron Age*, conform more closely to statements and statistics in vogue in the past few years.

Briefly stated, the Southern iron development of the last census decade—in States commonly included in the iron-making South—was a wonderful expansion in pig-iron making, but of retrogression in the manufacture of finished iron and steel.

THE STORY OF THE ARMOR PLATE TRIUMPHS.

The Bethlehem Iron Co. and the Carnegie Steel Co., Ltd., have been before the House Committee on Naval Affairs within the week, explaining why their deliveries of armor plate for government war vessels have not been as prompt as promised. The statements are an interesting commentary upon the the flippant criticisms so often passed by men who oppose the development of new industries in the United States, and who seek every occasion to display their hostility, during the experimental and developmental stage. This species of fault-finders has been wonderfully prolific in attacks upon the tin plate industry of the United States, because it was not full-fledged in a year. Its logical position is that the United States must continue to depend upon foreign producers in a given line, because it cannot at once have industries as perfect, and producing with the same economy as those abroad. This policy would make the United States dependent upon foreign powers, for example, for the armament necessary for defense against their aggression, should occasion arise.

The story told before the House Committee on Naval Affairs, by representatives of the Bethlehem Iron Co., showing how home capital and home engineering skill and persistence have put the United States Government in possession of an armor plate to which nothing made for European powers is comparable in resisting qualities, ought to call a halt upon the un-American critics of American industrial achievement. After explaining how the great hydraulic presses and other machinery made by Whitworth & Co., in England, were 18 months behind the stipulated time, and how, after its arrival, additional machinery had to be constructed for the building of yet other machinery, the Bethlehem representatives showed in detail how one step depended upon another. We condense the salient

points in the interesting narrative from a Washington special:

The giant hammer had to be forged, which is by many tons the largest in the world. The great Krupp works hammer is less than 90 tons. The Bethlehem hammer makes a stroke of 130 tons in weight. No less than three excavations were made and rejected before a bed of such quality was found as would warrant proceeding with the sub-structure of the giant anvil. This foundation spot was at last found in the bed of the river and the very water of the river had to be turned into a new channel to make room for the greatest hammer in the world.

Then came the marvelous experiments with the nickel plate and the Harvey process, which have produced an armor plate such as the world never dreamed of before, such as no other country can produce at this time, which have revolutionized the means of defending naval vessel, and on which the most powerful projectile yet invented is shattered as though it were glass. With this new process and harder plate came the necessity for other new machinery, some of which is not yet constructed. The saws and planes such as were used on the simple steel plates are not strong enough to trim and finish the Harveyized plates. The Bethlehem Iron Co. to their own loss and detriment had gone into experiments not contemplated, and were about to furnish a plate far beyond that expected by the government in resisting power.

Their plant was virtually constructed solely with the expectation of making armor plate for the navy. Before a dollar could be gotten in return about $3,500,000 was expended. Since the first contract was entered into another million had been invested. Nearly $1,000,000 worth of plates are now forged and piled up waiting for tests and for improved machinery necessary for finishing. Only about 1,400 tons of plates all told have been delivered and paid for.

Mr. Boutelle, of the committee, in commenting on the recital, said that in all his investigation he had never heard of a firm which had done so much for a government, referring to the gratuitous experiments in Harveyized plate and the construction of expensive machinery to make it.

In the hearing of representatives of the Carnegie Co., outside of the strike delays, with which the public is so familiar, facts were brought out similar to those developed in the other inquiry, as to the inadequacy of the British-made machinery and the necessity of making other machinery to supplement it. Estimates made as to the capacity of the plant to turn out a given quantity of rolled plate had been found by experience to be excessive, but within two years the company promised the finest plant for rolling armor plate, in the world.

The inquiry brought out a state of things in all ways creditable to t e companies inquired of and ought to make every citizen who has any interest in American achievement, proud of the record made in the infant armor plate industry in the brief time that native capital and brains have had a chance at it.

THE gradual enlargement of the warrant yard as a factor in the pig iron situation appears in a comparison of the stocks in yards at the close of the past two years. On Dec. 31, 1891, these stocks were 51,900 gross tons; on Dec. 31, 1892, they were 79,700 gross tons. Unsold stocks on the former date were 596,333 gross tons; on Dec. 31, 1892, 506,116 gross tons. That is, the warrant yard stocks at the close of '92 were 16 per cent. of the total unsold, while at the close of '91 they were 8.7 per cent.

WHATEVER uneasiness exists as to the effect of the policy of the new administration on the business of the country is tempered by the knowledge that coming Secretary of the Treasury Carlisle is a man after Cleveland's own heart on the money question.

A STATEMENT FROM MR. CARNEGIE.

Mr. Andrew Carnegie reached Pittsburg, last week, on his return from Europe, and on Saturday gave an interview to the Associated Press. He said in substance that he retired from business four years ago; that he has no power to instruct anybody connected with the Carnegie Steel Co., Ltd.; that the law under which the company is chartered requires a majority, not only in interest, but in number, of stockholders, to make a change. Though holding a majority of shares in the Carnegie Steel Co., Ltd., Mr. Carnegie says he would not rule by force, if he could; that when he could not bring his associates in business to his views by reason, he never did so by force. Any inference from these statements that he does not sustain Mr. Frick in the latter's policy throughout the late trouble is negatived by high commendation, in the interview, of Mr. Frick's management and abilities and expressions of thorough confidence in him "Good workmen or able men who wish to do what is fair and right will learn to appreciate Mr. Frick. Inefficient officials or bad, unreasonable, violent workmen he does not like, and these will not thrive with him." Mr. Carnegie says little about the Homestead trouble, merely asking that it be banished as a horrid dream, and then adding: "For 26 years our concern has run with only one labor stoppage at one of its numerous works, and I trust, and believe, that even this record will be fully equaled in the 25 years to come. When employer and employed become antagonistic, each considering the other its enemy, it is a contest between twin brothers. There is no genuine victory possible for either, but defeat for both capital and labor."

Changes in Cleveland Iron Firms.

Under date of Jan. 28, W. C. Runyon and W. E. Mack announce the dissolution of the iron ore commission firm of Runyon, Mack & Co., and that the business of the partnership will be settled by either of them. They had been associated in iron ore selling since 1886, the firm of Runyon, Stubbs & Mack being in existence from that year until 1890, and since the latter year the style has been Runyon, Mack & Co. Mr. Runyon will continue in the same business at the offices heretofore occupied by the firm, 596-7 Perry-Payne Building. Mr. Mack's offices will be in the Western Reserve Building. He will be in the same business as heretofore, but definite announcement as to his connection will be made later.

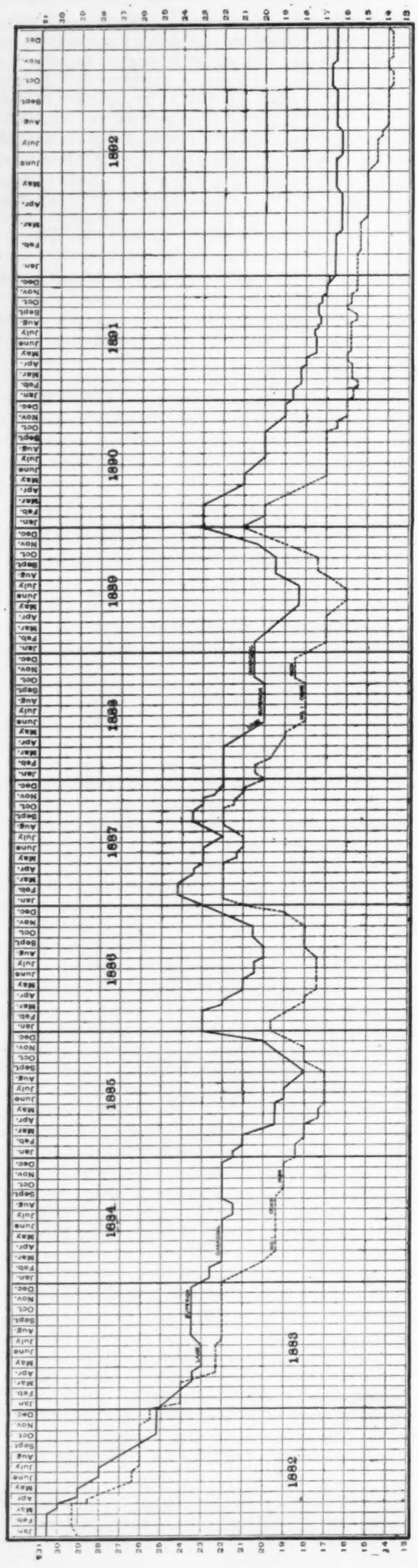
Mr. H. M. Doolittle, for a long time identified with the late firm of Cleveland, Brown & Co., has connected himself with the well-known Cleveland house, the Condit-Fuller Co., having been elected secretary of the company at its annual meeting held a short time ago. Mr. Doolittle has a large acquaintance among the trade and the new connection is one that will be mutually desirable.

Fire Losses by Chicago Machinery Firms.

The building at 62, 64 and 66 S. Canal St., Chicago, was totally destroyed by fire, Jan. 27, with $150,000 loss. The building, valued at $60,000, was a total loss. The basement was occupied as a warehouse by the Scully Steel & Iron Co., dealers in iron and steel. Their loss is estimated at $30,000, insured. The New York Steam Power Co., which had a large stock of engines and boilers and engine supplies, lost $13,000. The firm of Copeland & Bacon, engine dealers, sustained a loss of $8,000; Christ Stoelting, pattern maker, $8,000; Chicago Bamboo Co., $5,000; March-Davis Cycle Co., $10,000; Perch Mfg. Co., $2,500; New York Safety Steam Guage Co., $2,500; Samuel Lyon, $4,000; Marblehead Lime Co., $2,000, all covered by insurance.

THE preliminary announcement of the 21st meeting of the Foundrymen's Association at Philadelphia, Wednesday, Feb. 1, stated that bids were to be received on certain castings of which a list was sent to members; that Mr. John Wister would address the meeting on "Coke," and that there would be a discussion on the matter of selecting a committee to find out at what price contracts for castings have been given out.

THE directors of the Ohio Steel Co., of Youngstown, met on Jan. 31, and elected J. G. Butler, Jr., vice-president, to succeed the late Henry O. Bonnell, and Col. J. L. Botsford to take the vacant place in the directory.



PRICES OF COKE AND CHARCOAL IRONS IN THE CHICAGO MARKET FOR 11 YEARS, 1882—1892.

REDUCED FROM A DIAGRAM PREPARED BY CHAS. HIMROD & CO., CHICAGO, ILL. CONTINUOUS LINE—LAKE SUPERIOR CHARCOAL. BROKEN LINE—NO. 1 COKE IRON.

MECHANICAL VS. HAND STOKING.

A Duquesne, Pa., writer gives the Pittsburg *Dispatch* some interesting facts about recent tests made there of the relative efficiency and economy of mechanical stoking and hand firing. He charges the smoke that has long troubled Pittsburg to ignorance and wastefulness, and adds: "There are several mechanical stokers that have shown, not by any fine spun theory but in actual work, that an almost perfect combustion can be attained and maintained, and at the same time from 10 to 40 per cent. more water be evaporated per pound of coal than is possible when boilers are fired by hand." The results of two comparative tests are given as follows:

	Mechanical.	Hand.
Grate surface	30¼	27½ feet.
Height of stack	75	45 "
Draft suction	.675	.425 inches.
Average temperature flue gases	478	590
Moisture in coal	3½	3 per cent.
Moisture in steam	1.4	1.5 per cent.
Dry coal consumed	6,547	5,145 lbs.
Dry ash	603	604 lbs.
Dry combustible	5,944	4,541 lbs.
Coal consumed per square foot of grate surface per hour	18	15.6 lbs.
Water apparently evaporated	53,040	34,080 lbs.
Actually evaporated (corrected for quality of steam	52,298	33,569 lbs.
Water evaporated per pound of dry coal	7.98	6.52 lbs.
Per pound of combustible	8.79	7.39 lbs.
Equivalent evaporation from and at 212 per pound of dry coal	9.37	7.66 lbs.
Equivalent evaporation from and at 212 per pound combustible	10.34	8.68 lbs.
Horse-power on basis of the evaporation of 30 pounds of water per hour from 100° into dry steam at 70-pound pressure	149	96 horse-power.

The boilers and conditions were almost the same, except that one was hand-fired and the other mechanically or "stoker" fired. The tables prove that a smokeless manufactory is an economical manufactory. While the hand-fired boiler emitted the usual amount of smoke, the mechanically fired boiler was smokeless, except twice during the 12 hours when the fires were being cleaned, and then smoked but four or five minutes. The duration of the trial was 12 hours in each case; dimensions of the boiler 60 inches by 16 feet; number of tubes, 44; outside diameter of tubes, 4 inches; heating surface, 875 feet; average steam pressure, 90 pounds; average temperature of feed water, 80°.

The Jackson Park Search Light.

Following the enormous search light on Mount Washington, comes the announcement of another gigantic light projecting lamp. This has been placed on the high tower of the Transportation Building, at the Chicago Exhibition. The rays can be seen 60 miles away, and locate a man 20 miles distant. The light is the largest and strongest one in the world. It was made by Schuckert and Co., of Nuremberg, Germany. The light is what is known as a 4 foot reflector—that is, the great magnifying glass through which the rays are thrown to such a distance is 4 feet in diameter. The direct power of the light is 150,000 candles, without any glass whatever; with the big glass, however, the power is magnified to 160,000,000 candle-power. The carbons used in the radiator are 12 inches long and 1¼ inches in diameter. They are fastened inside the lamp merely with two upright pieces of steel. The lamp itself is operated on a sort of carriage, something after the manner of a Maxim gun. It can be turned in any direction, and can be tilted so that the rays will ascend straight up.—[Kuhlows.

Indiana Has Wasted $22,000,000 Worth of Gas.

An Indianapolis dispatch says: Advance sheets of State Gas Inspector E. T. J. Jordan's report to Geologist Gorby discloses the fact that there is a material decrease in the Indiana natural gas supply. The united pressure of the Indiana field was at first 325 pounds to the square inch. The pressure has decreased in some cases to 60 pounds, and many wells are entirely useless, some because the supply is exhausted, others on account of the presence of salt water. There have been 300 manufactories brought into the State on account of the cheap fuel. The Chicago Gas Co. has the best part of the field around Kokomo. The field in the immediate neighborhood of Kokomo is entirely exhausted. The greatest pressure in the Anderson field is 325 pounds. Prof. Gorby says: "There has been enough gas wasted in the gas field to supply every family in it for two years. The cash value of fuel thrown away is about $22,000,000."

AMONG THE IRON MINES.

Gogebic Range:—

Fire broke out on the fifth level of No. 3 shaft of the Palms mine at Bessemer, early in the morning of Jan. 24. The fire departments efforts were confined to throwing snow down the shaft and later the shafts were sealed in the hope of smothering the flames. The fire was confined to the shaft and at last reports was smoldering with good prospects of being soon overcome.

At the annual meeting of the Brotherton Iron Co., Tuesday, Jan. 24, at Milwaukee, the following board of directors was elected: Luther Sellwood, Duluth; M. J. Luthur, Streator, Ill.; Arthur Pugh, Racine; J. Parke Channing, Iron Mountain; J. B. Stubbs. Chicago; Henry Niedecken, Edward Niedecken, Milwaukee. The following officers were elected: President, Joseph Sellwood: vice-president, Henry Niedecken; treasurer, M. J. Luthur; Secretary, Edward Niedecken. The company mined 116,723 tons of ore in 1892, and this ore, with that left over from 1891, making 150,000 tons in all, was sold early in the season at $4.25 a ton. The net profit was more than $80,000, which enabled the directors to declare a dividend of $1 a share. The stock of the mine was sold for $3 a share last winter and is now quoted at $2.25. The president advised the company to mine all the ore possible in 1893, and if 50 cents a ton profit cannot be made to take what can be secured. In 1892, it cost the company $1.22 6-10 a ton to mine and place the ore on board the cars at the mine. At present 208 men are employed. An inventory shows that the company owns $26,099.10 worth of buildings and mining equipments. The treasurer handled $263,156.69 last year. The Brotherton will mine 125,000 tons of ore in 1893.

A dividend of $2 a share will be paid Aurora stockholders Feb. 24. There are 100,000 shares of $25 par value. The Aurora's shipment to date are 1,284,454 tons.

A large Worthington mine pump is being sent to the Ashland mine. It is guaranteed to lift 700 gallons of water to a height of 700 feet per minute. It is to take the place of a Cornish lift introduced some time since.

Vermilion Range:—

The Chandler has 100,000 tons on stockpile, and with 2,000 tons a day being hoisted, its record of last year will doubtless be equaled. No. 4 shaft will be put down to the eighth level and the work will probably be completed by spring. At the Zenith, the main shaft, now down 360 feet, will be sunk to 425 feet. It is expected that an output of 100,000 tons can be achieved in the year.

The "Section 30" case, involving iron lands valued at $3,000,000 was ruled upon by Register Nichols of the Duluth Land Office last week. The register holds that the order of Secretary Vilas re-opening the land for entry, after the filings of Hyde & McDonald had been set aside, was in force from the time it was issued at Washington, and that while the claim of C. P. Wheeler was the first filed after the order was received at Duluth, those of Wm. Alden and H. E. James take precedence because they were filed after the issuance of the Vilas order, but before it reached Duluth. Wheeler's claim, which is that of the Minnesota Iron Co., is allowed as far as it does not conflict with those of Alden and James, and he is given one-quarter section. The Germania Iron Co. claimed the land under a purchase from Emil Hartman, who was a contestant of the Alden and James claims. Another section 30 decision is that given by Judge Nelson, in U. S. Court at Duluth, in the case of the United States vs. Thos. B. Reed, the Germania Iron Co., and Hartman & Mallett. Judge Nelson declared void the Thos. Reed patent to the S. W. ¼ of the N. E. ¼ and lots 1 and 2 of Sec. 30, 63-11 and ordered its surrender to the Secretary of the Interior.

Mesabi Range:—

Two sets of articles of incorporation were filed recently with the register of deeds at Duluth. David T. Adams, Peter L. Kimberly and John T. Jones incorporate the Adams Mining Co. with $1,000,000 capital. G. A. St. Clair, Ishpeming, Mich., Peter L. Kimberly and John T. Jones file articles of the Lowmore Iron Co., with $500,000 capital. Both corporations will mine and deal in ore and mineral lands.

The Cincinnati mine has shipped thus far between 1,500 and 2,000 tons of ore to the West Duluth furnace of the Minnesota Furnace Co. A steam shovel will be employed to load the ore in spring.

The *Mesabi Range* says that at the Cincinnati mine, after drifting on the first level about 80 feet southward from the main shaft it was decided to sink down a few feet, and at a depth of five feet a fine quality of blue ore was encountered interlaid with hard manganese ore.

W. L. Brown, of Chicago, secured a temporary injunction before Judge Nelson, in U. S. court at St. Paul, last week, restraining the Duluth, Mesabi & Northern road, the Merritt brothers, Chase brothers, Donald Grant and others from transferring stock in the road or in the mine of the Mountain Iron Co. It was alleged that a large amount of stock was to be sold below par; that the road cost $580,000, whereas stock and bonds were issued to the extent of $2,500,000. The report was current that the suit was an attack on the credit of the road, proceeding ultimately from the Duluth & Iron Range road, but President Greatsinger, of the latter, in denying the report, said that the Duluth, Mesabi & Northern had no better friend than the Duluth & Iron Range. It was expected that the injunction would be dissolved.

Menominee Range:—

General Manager Cole, of the Schlesinger properties, is quoted as saying that the operation of the Claire, this year, would depend entirely on the market; if last year's figures could be secured, ore would be mined, otherwise it would not.

The bailers employed in unwatering the Hamilton have lowered over 1,000 feet, and when bottom is reached drifting will begin to No. 1 shaft. Bailers are also being made for the incline shaft at the Ludington.

New Process of Refining Steel.

The Pennsylvania Steel Refining Co. has secured the exclusive right to use in all the Middle States, where three-quarters of all the steel in the United States is made, the patents on a new process of refining steel. The process takes Bessemer or open-hearth low grade steel and converts it into high grade tool steel suitable for making chisels, shears, drill, lathe, planer and all kinds of machinery tools. It also makes a very superior article for cutlery purposes, being easily worked, taking a strong temper, and holding its edge when other steel fails. A complete physical change takes place in the steel under this refining process. It is claimed that the molecular changes are permanent, and the qualities of tensile strength and elastic limit are possessed to a greater degree than by any now manufactured. The company does not claim to refine iron or convert iron into steel, but confines its work to the refining of Bessemer or open-hearth steel, and this is done as fast as the billets can be heated. The tools made from this steel have been and are being worked in competition with tools made from the highest grades of steel. Considering the price at which it can be manufactured, it must of necessity become a very important commercial competitor in the market, as against the higher priced tool steel, both American and imported, now in general use. This steel being of such a high grade, it must be worked at a low heat and tempered at dark cherry.—[Railroad Gazette.

THE buildings erected six years ago on the site of the old Peninsular car shops at Detroit are to be occupied, if negotiations are completed, as now seems likely, by another car manufacturing company, which would employ about 1,000 hands. An option on the property has been secured at $300,000 in the interest of Boston capitalists. A gentleman connected with the Michigan-Peninsular Car Co., is thus quoted: "The freight cars of the company last year numbered 1,200,000, and the number of cars built in the last 12 months were 49,000. The average life of a freight car is only nine years, so it is easy to show that there is plenty of room for competition. I understand that the new organization is to be capitalized at $400,000. It ought to make money at that if our works can pay dividends on a capital stock of $8,000,000."

PROPOSALS will be received until Feb. 6, 1893, by D. H. Burnham, director of works, at Jackson Park, for line shafts and appurtenances for Machinery Hall, according to plans now on file in his office.

FURTHER ON PHOSPHORUS ELIMINATION.

TO THE EDITOR OF THE IRON TRADE REVIEW:

In your issue of the 26th appears an article by Mr. Jacob Reese criticizing some statements by Mr. Sisson which appeared in your journal, on the elimination of phosphorus from iron. According to Mr. Sisson phosphorus "is only eliminated by intense heat as in the puddling furnace, where about 90 per cent. can be eliminated, and in the basic process where from 96 to 99 per cent. may be eliminated." Mr. Reese summarizes his remarks by saying: "Phosphorus is separated from iron in the puddling furnace by liquation and in the basic process by differential specific gravity."

While the above statements may be to a certain extent correct, they are certainly decidedly deficient in completeness as to the conditions of phosphorus elimination.

The essential conditions for phosphorus removal from pig iron are, first, a basic slag and, second, an oxidizing atmosphere. This proposition was first clearly stated by Prof. Gruener in 1857 and is the principle on which is founded the basic Bessemer and open-hearth steel processes.

Phosphorus exists in pig iron in the form of phosphide of iron and is only removed by oxidation to phosphoric acid. Conditions which effect this oxidation also oxidize some of the iron and the phosphoric acid unites with the oxide of iron, forming a readily fusible slag, which separates from the metal. In the basic process the lime added also unites with the phosphoric acid as formed, thus partially preventing the oxidation of the iron.

The so-called "washed metal" process, discovered almost contemporaneously by Bell in England and Krupp in Germany (in 1877) consists in melting pig iron with iron oxide or iron oxide mixed with manganese oxide. In operating this process Bell soon observed that an essential to its success was a careful regulation of the temperature. In his own words he found that "at the lower temperature oxide of iron acidifies and combines with the phosphorus existing in the pig iron and that the phosphorus, after the carbon has disappeared, is retained in its new form of combination. When, however, the temperature was raised, the metallic iron recovered a portion of the phosphorus which it had parted with when the heat was of a less intense character."

In puddling (as also in the basic open hearth steel process) the metal loses about 50 per cent. of its phosphorus during the melting down and about 25 per cent. more during the "boil," so that at the beginning of the puddling the metal contains only about 25 per cent. of the phosphorus originally present. In the basic Bessemer process the phosphorus is removed only after the oxidation of the carbon and silicon—that is, at the end of the "blow." Yours very truly,

CLEVELAND, O., Jan. 30, 1893. G. A. BICKNELL.

Failure of Pottstown Iron Co. and Erie Car Works.

Two heavy iron failures are announced this week, after a considerable period of freedom from such occurrences, though with the strain that has been on for the past year the wonder is that disasters have been so few.

Receivers were appointed on Monday, Jan. 30, to take charge of the business of the Pottstown Iron Co., of Pottstown, Pa. They are Jacob Feely and Wm. M. Gordon, treasurer of the company. Bond was fixed at $500,000. The equity bill filed in court estimates the company's liabilities at $2,025,000, exclusive of $884,000 capital stock. It is thought that the company may be able to continue. The principle creditors in the bill of equity are Israel Morris, holder of $200,000 worth of bonds secured by a mortgage, with an indebtedness unsecured of $40,000, and a holder of $200,000 in capital stock; William H. Morris, a creditor for $80,000 and the holder of $120,000 in capital stock and $14,000 in bonds, and Theodore H. Morris, who owns $100,000 in capital stock and $20,000 in bonds. The president and active manager of the company is William H. Morris. South Bethlehem and Pottstown banks hold $60,000 of the company's paper. The company employes 2,000 men and has a plant estimated to be worth $3,000,000 and a production on hand and in progress worth not far from $400,000, and bills receivable to the amount of $350,000. It began business in 1866, and when its charter was renewed in 1886 had $500,000 paid in capital stock, cash assets of $280,000 and property worth $970,000. A director of the company said this evening that the company's embarrassment was brought about by the continued investments to keep up with modern improvements and three or four close years. The other failure, and one that caused much surprise, was precipitated by a sheriff's levy on the Erie Car Works, Ltd., at Erie, Pa., on executions aggregating $102,000, in favor of Erie banks. The plant of the concern, representing a $500,000 investment, covers 10 acres and comprises car works, car wheel works and the Martel charcoal iron furnace at St. Ignace, Mich. The furnace has a capacity of 23,000 tons of car wheel iron annually. It is said to have been the cause of the failure. The Erie plant had a large contract on hand for new cars for the Pennsylvania road.

In the Valleys.

The Quaker Valley Mining Co., of Youngstown, have recently purchased extensive coal lands in Columbiana county, with a view of erecting a large coke works to supply Mahoning Valley furnaces with coke. Some of the gentlemen interested state that it is expected to make a first-class quality coke equal to the Connellsville region product. If such is the case, the valley furnaces will be able to compete with any locality in the United States, as the existing disadvantage to the valley pig iron producers will be removed—high freights on coke from the Connellsville region. The rate from Columbiana county coal lands to the valleys will not exceed 50 cents per ton. This will be a great advantage to local pig iron manufacturers.

Several rolling mills in the Shenango Valley and two mills in the Mahoning Valley have about abandoned puddling and steel billets are used instead. It is predicted that the steel billet will be used in three-fourths of the mills here before another year unless the price of puddling is reduced next July. Some of the manufacturers say they must have $4 puddling to compete with the new article. The employes on the other hand, say they will not submit to any such a cut without a long, bitter strike, as they claim that even at the present wages they can earn on an average but $900 a year.

The Alice Furnace, at Sharpsville, Pa., operated by Pickands, Mather & Co., and Wheeler Furnace Co., is now ready to start up as soon as the coke supply can be secured. The Alice has a capacity of 100 to 125 tons daily. The company's two furnaces at West Middlesex, the Elia and Fannie Furnaces are still out and will likely remain so until the pig iron business improves.

Personal.

M. R. Hunt, of Ashland, Wis., a well known furnaceman, will be manager of the furnace that is to be built at Ironwood, Mich., by the newly formed Gogebic Iron & Steel Co.

Julian Kennedy, the well known blast furnace and steel works engineer, who is designing the plant the Ohio Steel Co. will erect at Youngstown, O., is engineer for the Ferris observation wheel at the World's Fair. The wheel is to be 256 feet in diameter, and will be driven by two 30x48-inch Porter-Hamilton engines built by Wm. Tod & Co., of Youngstown.

Victor Colliau, a chemist and mechanical engineer, known throughout the iron world by reason of his inventions, died at Detroit, Jan. 17, aged 66. His device for saving fuel in iron melting and his Colliau cupola are his best known inventions.

Benj. F. Fackentha, for many years superintendent of Cooper & Hewitt Co.'s Durham furnace, at Riegelsville, Bucks Co., Pa., has been elected superintendent of the Thomas Iron Co.

On the Editorial Table.

The February *Wide Awake* has a delightful reminder of Tennyson in Carroll Burton's "Child-Life at Farringford," described by one who actually visited and played with the Tennyson boys. The same number also contains the second of Frederick A. Ober's Columbus articles—"From Corday to Cathay"—called "At the New World's Portal."

Under the head of "Geological Survey," Gov. David R Francis, of Missouri, says in his biennial message, just issued in pamphlet form, that since the establishment of the Bureau of Geology and Mines in 1889, "A general examination of the coal deposits has been made in 25 counties; an examination of the iron ore in 54 counties; of the clay deposits in 80 counties; of the mineral waters in 20 counties; of the zinc and lead deposits in 41 counties, and a study of paleontology has been made in 26 counties."

CHEMISTRY AND FOUNDRY PRACTICE.

Clemens Jones, M. E., of Easton, Pa., formerly chemist for the Thomas Iron Co., read a paper at the last meeting of the Foundrymen's Association, at Philadelphia, held Jan. 4, on "The Relation of Chemistry to Foundry Practice." The early portion of the paper is taken up with an excellent summation of the various elements occurring with iron—carbon, silicon, phosphorus, manganese, sulphur, aluminum, arsenic, titanium, copper, calcium, magnesium. Definitions are given, together with characteristics of each of these elements. The writer then proceeds as follows, "in an endeavor to interpret not only the meaning of their appearance but also to inquire what amounts of each, or all, fulfill the requirements of our search:"

Pig iron is the raw material out of which the foundryman is required to make a finished casting. What is pig iron? Pig iron is impure cast iron. It is metallic iron combined with nearly all of the metals and metalloids that were contained in the raw ores, the flux, and the combustibles employed in its manufacture. As it comes from the furnace it is unfit for any but the simplest castings. Uncertain in quality and weak, it contains blow holes, is liable to chill and to excessive shrinkage, and is full of foreign fragments floated on its molten surface, as it rises to the top of the mold. This crude iron is in a condition to be cheaply purified and converted into articles most needed in the arts. In the early centuries, before cast iron became in vogue, pure iron was sought as a direct product. The direct process was used until the fifteenth century, and is still extant, notably in China, India and Africa. But these charcoal bloomeries required the finest selected materials, and involved tremendous labor and great expense. Besides, there is no use for chemically pure iron in the arts. On this account its manufacture is not attempted.

But iron is combined with other elements, which we regard as impurities, until it has a required hardness, combined with a required strength. The elements employed to effect this change in the physical properties of iron are commonly carbon, silicon, phosphorus and manganese. As we have seen, there are other accidental impurities possible, which may comprise the whole list of elements we have discussed. Nature, provident in this, the greatest need of mankind, disposed of these needful elements in such relation to the deposits of iron ores that crude iron—the alloy with requisite properties—is readily produced, suited to the needs of the artisan. Indeed, so wide is the range in this respect that in earlier days quantity only, without respect to the quality, of the pig iron, was the sole object. Materials were tumbled into the blast furnace without rhyme or reason, and in utter disregard of those self-controlling conditions of the process itself which alone were often responsible for a product that was fit for any purpose. Or, on the other hand, the founder's complaints to the furnaceman prevailed in such incessant changes of materials that by an accident of experiments the proper iron was at last made. Without doubt this state of affairs retarded any considerable progress in foundry practice. But blast-furnace practice has undergone a revolution. Chemical knowledge has brought it about. To-day the foundryman is in a position to say to the pig iron maker, "I want such a quality of iron;" and the furnace manager is in a position to light his fires and make it. The pig iron industry is of such great importance that, independent of economical considerations, he will be obliged to make it. The report of the mineral products of the United States just distributed places the production of pig iron for the year 1891 at nearly 8,300,000 tons, having a value at this city of over $128,000,000. We may, therefore, look confidently to the present day as the dawn of light upon subjects long in darkness. Good workmanship in the foundry requires intelligent methods. These begin with the selection of appropriate materials—those having the right composition. It stands to reason that foundrymen are restricted when they undertake to handle material concerning which they do not possess any chemical knowledge.

While pig iron is usually weak and unreliable, there are instances on record of very strong irons. A good pig iron should stand a breaking strain of at least 15,000 pounds to the square inch. A well-known brand of Pennsylvania iron has an average tensile strength of 17,000 pounds to the square inch. The first remelting of this iron gives a strength of over 22,000 pounds. One test of this brand of iron gave in a gray forge iron the unusual strength of 52,000 pounds to the square inch.

GRADING PIG IRON.

We will not spend much time on the subject of the grades of pig iron. Grading at best is but a local designation. It has the advantage, however, of approximating to the end in view. The grades of pig iron with reference to fracture, may be classed in the following order: Silver gray, brittle, large bright crystals, open grained. 1x, tough open grain free to edges; torn fracture, jagged to the touch. 2x, similar to 1x, but having close-grained spots. 2; even close grained. 3, or gray forge, hard and finely grained. 4, or mottled and white irons. The composition of pig iron, taking the average of the Pennsylvania brand mentioned, for foundry use is about as follows:

	Per cent.
Carbon, graphitic	3.75
Carbon, combined	0.20
Silicon	2.50
Phosphorus	0.75
Manganese	0.30
Sulphur	0.06
Total	7.29
Iron, etc	92.71
Total	100.00

Iron of this composition will answer for general use, will be fluid and make a strong, soft casting. We find from the analysis the amount of each ingredient. Now, in actual practice, we will suppose that this given iron is entirely satisfactory when made into castings for a certain purpose. It melts easily, requiring a modicum of fuel, fills every crevice in the mold, comes out a perfect casting, and can be readily shaped on a lathe. This quality of iron, then, would naturally be sought for similar work. What is there in the appearance of pig iron to indicate its quality? Grading by fracture will not determine quality—that is, composition. Grade alone, judged by the fracture, is of no practical service whatever. Taken in connection with known composition it is of valuable assistance.

There are claims held by reputable iron men that the fracture indicates carbon, silicon and every other constituent, presumably to the practiced eye. Still others hold that the face of the pig is an infallible guide for everything. Relied upon by itself there can be nothing more deceptive; the eye, no matter how finely educated, cannot see phosphorus, sulphur, silicon or anything else in an opaque, solid mass. If the blast furnace produced iron at each successive cast of perfectly uniform composition there might be a shadow of validity to such claims, since the free carbon as graphite under regular conditions, is a fairly good indicator. But it has been clearly shown by the best authorities that the two principal ingredients, carbon and silicon, are liable to be affected not only by the temperature of the iron, but the rate of cooling and other physical causes, other conditions being constant. As a matter of fact, not only do graphite and silicon vary in different casts, when using the same mixture of ores, etc., but there is even marked variation between the pigs in the different beds. It is asserted on good grounds that graphite is an index of silicon, for the reason that in certain amounts it changes the combined carbon to graphite—that is, precipitates it. But what visible means is there of determining exact amounts of silicon? There are many recorded cases of rich open grained irons that in reality contained hardly enough silicon to make the melted iron pour without clogging.

ANALYSIS ALONE CONCLUSIVE.

Analysis from this array of facts is the only true guide. In these connections the relations of chemistry to foundry practice cannot be misapplied. Here a practical illustration may be of service. Pig iron is introduced into a cupola, fuel is added, flux is added to take up the excessive impurities, a current of air is blown in to increase the heat. The pig iron was smelted from its ores—chemical forces operated to produce it. The fuel, as we have seen, is a form of carbon—a chemical substance. Lime is the base of the flux employed; it unites with the acid impurities to form a liquid purifying bath—by chemical reactions. Oxygen, the tireless vital principle of the air, causes the combustion of the fuel with generation of intense heat—a type of chemical energy. The molten fluid metal, sparkling in the ladle, fills every crevice of the mold, and is at last uncovered from the steaming sand—a chemical product.

Cast iron is that kind of iron which neither tempers nor welds. This is rather a distinction than a definition. It com-

pares with steel, which is that kind of iron capable of assuming temper, and with wrought iron, which may be welded, but will not take temper by chilling. There are, however, qualities of steel which may be welded, bent, and do not take temper. But to a certain extent these distinctions are caused by the behavior of carbon, and at the same time the absence of certain other elements. White iron becomes steel when its carbon is reduced to about 1.5 per cent., at which point it has slight weldability and great hardness. We may say that cast iron is a compound with varying quantities of carbon and silicon. Steel may contain silicon, but has less carbon than is needed to form cast iron. Wrought iron is nearly pure.

Let us now briefly examine the influence of the chemical elements with which we have become acquainted upon the quality of cast iron. When pig iron is melted in a cupola we look for a slight change of composition in the resulting cast iron, owing to oxidation caused by the blast of air. The tendency of this effect is to lessen the amounts of the more readily oxidizable elements, such as manganese and sulphur. Silicon and combined carbon afford combustible material to oxygen, and these elements are burned and also reduced in quantity. The practical effect, when a mixture contains the right proportion of carbon, silicon, phosphorus and manganese, is a uniform iron, in which, so to speak, the carbon as graphite is finely subdivided. This state of subdivision, in which all the carbon is still graphite, increases the tenacity between the particles of surrounding metal by placing them in closer contact and imparts a texture resulting in greater strength. By the same process, it is well known that up to a certain point subsequent remeltings give greater strength to cast iron, which from the first melting may be even doubled. We do not know accurately whether in addition to this the alloy may not be said to be intensified, and a firmer grasp upon each other given to the combining elements. But the texture is improved by a rearrangement in molecular structure, and the actual composition may not have varied to any considerable extent. Illustrative of the effect of melting on pig iron, the following analysis, quoted by one of the greatest authorities on the subject of iron, will be instructive in several ways. The iron was graded as No. 1 pig. On remelting, it turned hard and white. The analysis of the original pig, and as remelted for castings, was as follows:

	Pig.	Castings.
Carbon	1.61	1.65
Silicon	0.98	0.61
Phosphorus	1.37	1.25
Sulphur	0.16	0.29
Manganese	0.12	0.47
Calcium	0.40	0.81
Magnesium	0.29	0.43
Total	4.93	5.51
Iron	95.15	94.42
Total	100.08	99.93

Observe that phosphorus and silicon sustained a loss, but the carbon remained practically the same, and sulphur and manganese increased, as well as the other two ingredients. Now, the phosphorus and silicon were oxidized, but the carbon was in all probability entirely graphitic. The gain in sulphur and manganese was undoubtedly due to bad fuel--a frequent source of trouble to the foundryman. Previous analysis of this particular pig iron would have avoided all difficulty. A critical study shows that it was deficient in carbon —should have contained twice as much. With the low silicon—of which the same holds good—this iron would have turned white, supposing that sulphur and phosphorus were not excessive. The abnormally high phosphorus and sulphur only increased the hardness of the metal. The gain in manganese is unusual, and had reached a point where, with the other constituents normal, chilling is so often sure to follow. Of calcium and magnesium, aside from the correctness of the analysis, the effects need not concern the result. But it is highly probable that had carbon and silicon been normally high, the increase in these elements, as well as sulphur and manganese, would have been prevented. Now, the analysis would have shown the deficiencies in this iron. With a knowledge of the chemical effects of these elements on cast iron, no foundryman would have attempted to melt this iron alone. It is important to understand clearly the fact that these chemical effects produce physical properties. The remedy is simple. The analysis points it out. A mixture of this iron with another iron containing more carbon and silicon and less phosphorus and sulphur, so as to result in a composition corresponding to that of the Pennsylvania iron, would have made soft, strong castings. Hence the practical application of chemical analysis to the materials used in the foundry is apparent.

PERCENTAGES OF VARIOUS ELEMENTS.

The quantities of the chemical elements in cast iron giving the best physical and economic results have been fairly well established. They may be considered in their relation to cast iron as hardeners and softeners. Carbon is a hardener. In pig iron carbon rarely exists over 5 per cent. Metallic iron is capable of combining with 7 per cent. as a maximum. Beyond this amount it separates out as graphite, of which "kish" is an example. But part of the carbon is replaced by the other elements, as already pointed out. As a consequence it rarely exceeds 4 per cent. In the condition of graphite the range in cast iron is from 3.5 to 4 per cent., in which amounts it imparts the greatest strength, for which purpose it is necessary. Carbon makes iron work hot and gives it fluidity. It makes it soft and easily cut by a tool. Silicon is the regulator of carbon in cast iron. Cast iron comparatively free from other elements and high in combined carbon is white, crystalline, hard, brittle and may be specular. Silicon appears to change the combined carbon to graphite and produce gray iron. It therefore adjusts carbon to make cast iron hard and strong or soft and tough. The range of silicon is wider than that of carbon. Over 3 per cent. of silicon gives hardness to cast iron and increases shrinkage. At 2.5 per cent. it gives maximum fluidity to cast iron, which can be used for the thinnest castings. But if a large casting, to be subjected to tensile strength or to resist a great crushing weight, the amount of silicon should be less. Silicon thus plays the part of both hardener and softener. Cast iron is soft and easily worked, containing from 2 to 2.5 per cent. of silicon. For common castings, such as pipe, etc., even 1.75 gives good results. Phosphorus should always be well controlled. With proper adjustment of the other ingredients it makes iron hard and causes excessive shrinkage. Some authorities consider 0.50 per cent. all that is necessary, but more than this amount may be safely employed. The range, however, is more limited, and, except where very fluid iron is required, should not exceed 0.80 per cent.

High phosphorus sometimes results in hard spots in castings. Manganese makes iron brittle and increases shrinkage, chilling and hardness. It weakens iron and increases its ability to stand stress. On this account more than 0.40 per cent. is undesirable in ordinary cast iron. It is a useful ingredient in making chilled castings, such as rolls, etc. Above 1 per cent. the hardening properties are lessened. Sulphur is one of the ingredients whose presence is not sought. It is a great hardener, and appears to increase combined carbon, which, as seen, is inimical to soft iron. It is always injurious to iron. In wrought iron sulphur causes brittleness at a red heat, and makes it "red short." This property is opposed to the influence of phosphorus, which makes it "cold short" at ordinary temperatures. But these terms do not properly apply to cast iron, although there is an old foundry saying, that a neutral iron may be made by combining red and cold short iron. Aluminum exists is such small proportions in cast iron that its influence is not often felt, but it appears to impart strength and elasticity. Introduced into melted iron, it is considered to act beneficially by collecting scum and slag, and produces sounder castings free from blowholes. Arsenic acts very much like sulphur on cast iron and is as greatly to be avoided, although but seldom encountered. There is no evidence to show that titanium injures cast iron, perhaps one reason being that it occurs in only small quantities. Copper is a hardener of iron, and in appreciable amounts weakens it. The other rarer elements, nickel, chromium, tungsten, etc., are so rarely to be found that their effects on cast iron are not accurately understood. They have been more used in connection with steel, the strength of which they appear rather to increase than diminish. But their occurrence in pig iron, and our knowledge of the fact, will pave the way to any future enlightenment concerning the effects they may produce.

Cast iron with the properties generally required, we may consider to be of a composition of from 3 to 4 per cent. carbon; 1.75 to 2.75 per cent. silicon; 0.25 to 0.85 per cent. phosphorus; 0.15 to 0.35 per cent. manganese, with as few other impurities as possible. The final point in our discussion is, as to

whether it is better to depend on chemical analysis or upon practice in making iron castings. There will be no dissent from the opinion that they must and will go hand in hand. Since we can govern the amounts of the ingredients of cast iron, any desired property may be given to castings of which it is composed.

There is no law as yet resulting from the commerce between the laboratory and the foundry. Without doubt, there is too much to learn that prevents the formation of simple, definite rules applicable to modern foundry practice. But these will come in time as the relations of chemistry to foundry practice become better and more generally understood. There are a thousand minds at work on the problems of science—chemists thinking in every language of the civilized globe of the subjects we have here discussed. Science improves every industrial condition to which it is applied. It is not possible, with accumulating facts rising to activity, that even in so humble a factory as the iron foundry they may not find practical application from day to day.

CLEVELAND TESTS OF NICKEL STEEL.

Nickel produced at the Brooklyn Nickel Works, near Cleveland, by the Canadian Copper Co., which brings its ores from Sudbury, Ont., was tested in steel-making at the Cleveland Rolling Mill Co.'s works last Fall. Jules Garnier, the French engineer, who has written and experimented extensively on nickel, and under whose direction the smelting works at Brooklyn were erected, has sent to *Le Genie Civil* the results of the tests. These were designed to determine the relative quality of steel with and without the addition of nickel. The two steels, as is shown in the accompanying table, differed only in the amount of nickel added to one of them, the quantity being about 3 per cent.

The method of manufacture and the charges of both heats were absolutely identical. The ingots for both heats were rolled into boiler plate under ordinary conditions.

Charge.	Size in inches. 8-inch specimen.	Section. Square inch.	Elongation. Per cent.	Elastic limit. Pounds per sq. in.	Tensile strength. Pounds per sq. in.
Nickel steel:					
Scrap, 9,000 lbs.	1.602 x 0.300	0.4806	23¼	.....	64,080*
Pig, 9,000 lbs.	1.645 x 0.245	0.403	26	47,100	66,370
Ferro, 165 lbs.	1.605 x 0.302	0.4847	25	44,700	66,000
Nickel, 540 lbs.	1.582 x 0.245	0.3875	24½	47,400	67,100
	1.495 x 0.310	0.483	26	47,300	64,890†
	1.495 x 0.310	0.483	23¼	48,200	66,200
Ordinary steel:					
Scrap, 9,000 lbs.	1.545 x 0.245	0.3785	26	35,700	55,500*
Pig, 9,000 lbs.	1.666 x 0.245	0.408	26	35,500	54,600
Ferro, 160 lbs.	1.670 x 0.292	0.4876	27½	32,800	53,900
	1.640 x 0.290	0.4756	32	34,060	52,500
	1.500 x 0.303	0.454	27	35,500	53,700†
	1.480 x 0.305	0.451	26	37,900	56,500

*Not annealed. †Annealed.

The deductions made from these results are these:

1. Nickel steel has on an average a higher limit of elasticity of 11,400 pounds per square inch, or nearly 31 per cent.

2. Nickel steel has an ultimate tensile strength greater by 10,400 pounds per square inch, or an increase of about 20 per cent.

3. The ductility is not reduced by the presence of nickel.

THE Lloyd Booth Co., of Youngstown, O., has been very busy the past few months on special contracts. It has completed the machinery for the tin mills of the Falcon Iron & Nail Co., at Niles, O., and now has under construction a 126-inch knife squaring shear for the Aetna Iron & Steel Co., of Bridgeport, O. It will furnish the 9-inch guide train for the new Minneapolis rolling mills. A pair of 30-ton power cranes are to be installed in the new foundry addition to the company's works.

THE Durand Stove Co.'s works at Medina, O., which have been closed for some time, owing to a disagreement among the stockholders, will resume operations, a party of Medina gentlemen having secured control. A. Munson has been elected president, G. C. Shepard secretary, O. C. Shepard treasurer, and A. T. Blackford general manager.

WHEELER'S VERTICAL WATER TUBE BOILER.

The cut in this column represents the vertical water tube boiler patented by E. A. Wheeler, of Sharon, Pa. Five patents have been granted Mr. Wheeler on his boiler and furnace setting and he has quite a number of the boilers in use. Testimonials received by the inventor indicate entire satisfaction with their operation. The Wheeler boiler is intended for burning gaseous fuel and is more especially adapted for blast furnaces, also for using puddling or heating furnace waste heat, in rolling mills, but can be used with coal or other fuel. The water and steam are contained within the tubes and upper and lower drums, shown in the illustration. The whole is enclosed with fire brick walls, for which the foundation is shown. The air and gas flues are under the boiler and do not show, but a jet of hot air comes in contact with each gas jet of twelve inches apart along under each side of the boiler, and causes complete combustion. The burning gas strikes the lower cylinder, or drum, and then passes up through the brick checker work built between the different sections, and is thrown right and left among the water tubes. The flames heat the bricks and the hot bricks intensify the heat from the burning gas. The waste gas and heat then pass through and among the water tubes, and escape through the stacks.

The claims of the inventor are thus stated: The advantages of these boilers, as demonstrated in actual use, are these: Their safety from explosions; their rapid steam making qualities, producing a large amount of steam from a small amount of fuel; the small space occupied; and their freedom from scale. The circulation is fully provided for by the water columns outside of the brick walls, connecting the upper and lower drums or cylinders. These have expansion joints. The tubes being vertical no dust collects on the outside of them and the sediment and scale in the water inside drops from the tubes into the drums below and is blown off. The large heating surface the tubes and drums present causes rapid generating of steam.

Orders can now be filled for any size of the Wheeler boiler, from 50 to 300 horse power. Letters should be addressed to the inventor.

THE Pottsville, Pa., Steel & Iron Co., employing 1,000 hands in connection with its furnaces, rolling mills and bridge works, has started an insurance arrangement with its employes. For temporary disability, one-half of weekly wages will be paid, limited to 50 weeks; loss of an eye, hand or foot, expenses and one-fourth of a year's wages; both eyes, etc., half of a year's wages; death within three months, expenses and a year's wages—no idemnity to exceed $1,500. Riots, strikes, etc., dissolve the insurance. Policy holders must pay 1 cent on each $1 earned. No refund will be made in the event of discharge or voluntary retirement from the company.

POSTED in the Beaver Falls Mills of the Carnegie Steel Co., Ltd., at Beaver Falls, Pa., is the following: Employees at these mills will bear in mind that any attempt to organize labor unions will not be tolerated, and any person or persons attempting to introduce labor organizations in these mills will forthwith be discharged and debarred thereafter from getting employment in any of the works of this firm.

WM. S. EVANS LODGE No. 3, of the National Union of Iron & Steel Workers, has been organized at Oliver's Tenth street mill, Pittsburg. It has 50 members, said to have been lifted from the Amalgamated Association. The Finishers' Union now claims a membership of 500 in Pittsburg.

NEW YORK'S BIG BRIDGE PROJECTS.

Bridge-building under way and bridge-building in prospect, in and about New York City, mean no small tonnage of iron and steel for the immediate and the more remote future. Four big bridges are interesting Gotham capital and Gotham taxpayers at the present time—the two over the East River, plans for which the Secretary of War has approved recently; the great bridge over the North River, to connect New Jersey with New York City, at 70th st., and the new Central bridge at 155th st. and 7th ave., now under construction.

The height of the present bridge over the East River—the Brooklyn bridge—is 135 feet in the center above mean high water. This height was established by United States authority. In approving the plans for the two proposed bridges, Secretary of War Elkins makes one modification: the lower chord of the bridge, from Broadway ave., to a point between Delancey and Rivington streets, is required to have a clear headway at its center of 140 feet above mean high water under the most unfavorable conditions as to load and temperature, and the drawings have been returned to the East River Bridge Co. for alteration in accordance with this decision. The plans for the Hudson avenue bridge were approved without change as to its height, which is 135 feet. There will be nothing like the long interval between plans and completed construction, in the case of the two proposed bridges, that elapsed after the passage of the authorization act in the case of the Brooklyn bridge. Congress passed the act in 1869; in May, 1870, the lowering of the caisson was completed. Not until May, 1875, was the Brooklyn tower completed and the formal opening of the bridge did not take place until May 24, 1883, or 14 years after the Secretary of War had fixed the height of the bridge. This time ought to be cut in two, in the case of the proposed new bridges; likewise the $15,000,000 cost of the Brooklyn bridge.

The East River Bridge Co. representatives say that the company is ready to begin surveys and construction any time and that plenty of money will be forthcoming as it is needed. The report that George Gould has an extensive interest in the project is denied.

The bridge over the North River connecting New York and Jersey City is a dream of years. From the beginning of railroads, Western travelers have been obliged to leave their trains in Jersey City and cross the river in a ferry. It is proposed to change this.

The commissioners of the New York and New Jersey bridge have adopted plans for a high railroad bridge so that trains can go direct into New York City, and also so planned that vessels can sail under it without the use of any drawbridge. It is to be 60 feet high above the water. On the New Jersey side the banks of the river are bold and rocky, and of sufficient height for such a crossing. On the New York side there are to be high piers, with an easy incline to the station farther down town. The site for the crossing is at 70th street, and the new union station is to be at the intersection of Broadway, 7th avenue, and 42d street. There is to be a steel viaduct between the bridge at 70th street and the new station at 42d street. This viaduct is to have floors of steel, on which the tracks are to be laid with rock ballast, so that a high rate of speed can be maintained without noise or jar. This is the principle on which many of the large English bridges are constructed.

The total length of the new bridge will be about 10,680 feet, and the main grade from the bridge at 70th street to the station at 42d street will be at the rate of 45 feet to the mile. The station will require two entire city lots at 42d street, each 200x800 feet, and will contain an area of nearly four acres.

The bridge is to have four tracks, and the piers and approaches are to be made strong enough for six tracks whenever the increase in business shall require them. There are to be 20 arrival tracks at the new station on the upper level and 20 departure tracks on the lower level immediately beneath them, so that trains can be unloaded and dispatched with celerity. Western passengers who arrive in New York by the Baltimore & Ohio, or the Erie, or West Shore roads will be carried swiftly across the river, and will leave the train at the 42d street station. The bridge will be owned by an independent company, and any of the lines on the New Jersey side which choose to do so will be given facilities for the crossing of their trains.

From the five great passenger stations in Jersey City there now arrive and depart over 1,000 trains daily, and it is estimated that over 80,000,000 passengers cross the Hudson river by ferry during the year.

The legislature of the State of New York has given the necessary authority for the construction of the bridge, and this authority has also been granted by the State of New Jersey. The commissioners are now waiting for the consent of Congress, as a navigable stream cannot be bridged without the permission of the United States government.

The fourth bridge, that at 125th street and 7th avenue, New York, is actually under way. The members of the American Society of Civil Engineers inspected the work while in New York at their recent meeting. The temporary bridge has been completed, and the foundations of the new structure begun. Pneumatic caissons of steel are used to reach solid rock in the bed of the river. The caisson is 100 feet long, 19 feet wide and 10 feet high. The interior, in which the men work, is 60 feet in diameter. There are five vertical cylinders or air-locks, through which the workmen pass and the material is sent down.

The draw of the new bridge will have a length of 412 feet, and will be 65 feet wide. Its total weight will be 1,700 tons. It will be, therefore, the heaviest draw in existence. The approach to the bridge on the east side will be 1,100 feet long, made up of 100-foot spans. It will run through the low land south of the lower end of Jerome avenue, and enter the avenue at a point 200 feet from the old bridge.

The 155th street viaduct will be the western approach to the bridge. This structure is 1,600 feet long and extends from the top of Washington Heights along 155th street to the new bridge. It is 60 feet high at its western end and 20 feet high at the eastern end. The foundations are all upon piles driven 30 feet into the ground. The bridge will be entirely of wrought iron and steel. In a structure of this kind especial provision has to be made for expansion and contraction. At every alternate set of posts the girders will rest upon small iron rollers which will have a free movement.

The time limit set for completing the bridge is two years, but it is thought it will be finished in about 18 months. The work is under the direction of Alfred P. Boller, consulting engineer in the Department of Public Works.

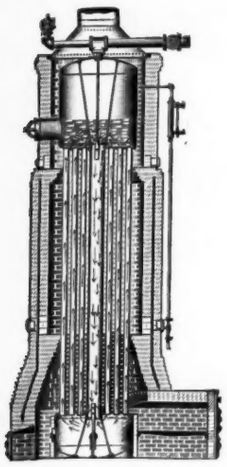
Great Docks for Mesaba Ore.

The Duluth correspondent of the *Marine Record* gives the following interesting facts about the iron ore dock to be built on the bay front at Oneota for the Duluth, Mesabi & Northern, or Merritt, road.

It is expected that the dock will be ready to ship ore about next August, though it will be impossible to complete the entire structure for at least a year. It will have a capacity for storing at one time 90,000 tons of ore, or a shipping capacity of nearly 3,000,000 tons a year, equal to the entire ore dock plant —four mammoth docks—of the Duluth & Iron Range road. A total of 12,000,000 feet of lumber are to be used in this dock, the entire season's product of a mill of no small dimensions. It is not probable that the dock will cost less than $400,000, practically all of which will be labor, in Duluth district saw mills, in Duluth rolling mills and bolt works and at the site.

The dock proper will be 2,500 feet long, and will extend from 75 feet riverward from, and at right angles to, the tracks of the Duluth Transfer Co., to the government channel. It will be 52½ feet above mean water level, and 50 feet wide, and on the top will be four railway tracks extending the entire length, and so spaced that trains may run on any two adjoining rails. It will have 500 ore pockets, each of a capacity of 180 tons, and because of the soft and gravel-like nature of the ores of the Mesaba, the dock will be one foot higher than any now in use. It will be fitted with automatic steam or compressed air hoists for the ore chutes, and with other similar improvements that will make it, in addition to being the largest, as well as the speediest dock in the world. It will be arranged so that it can accommodate vessels drawing 20 feet of water when that depth becomes practicable, in 1896. Eight thousand spiles are now being driven for its foundation.

The dock bill for the Duluth & Iron Range road, which is now being got out, is for 5,100,000 feet, and with extras, 6,000,000 feet. This amount is required for the addition to the D. & I. R. docks at Two Harbors.



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"Semi-Steel"

Works: SOUTH CHICAGO.

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ALL KINDS OF

Foundry Supplies.

FACINGS, BLACKINGS AND MOULDING SANDS

Of All Kinds.

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trade:

Chicago, Ill.—Frazier Cycle Co. ;capital, $10,000; to manufacture bicycles, etc.; incorporators: Edw. S. Frazier, Geo. S. Webb, Walter S. Frazier, Lincoln B. Frazier.

Chicago, Ill.—Magnetic Boiler Cleaner Co.; capital, $100,000; to manufacture and deal in boiler cleaners, etc.; incorporators: J. Clark Williams, J. A. White, Amelia Lehmann.

Grafton, Ill.—Rippley Hardware Co.; capital, $15,000; for general merchandise and manufacturing business; incorporators: Wm. H. Allen, Jr., Harry W. Schafer, Frank Rippley.

Buffalo, N. Y,—Queen City Engineering Co.; capital, $10,000; for the manufacture of steam pumps, etc.; incorporators: August Goerlitz, Edward Ritter, Geo. Volker, all of Buffalo, N. Y.

East St. Louis, Ill.—The Dealers Steel Fence Co., capital, $300,000; to manufacture and deal in steel, iron and wire fencing; incorporators: Wm. R. Faxon, Henry F. Vogel, Frank G. Rhoades.

Willamsport, Pa.—Provident Mfg. Co.; capital, $100,000; for the manufacture of mechanical and other appliances, novelties of wood, etc.; incorporators: Godfrey Hess, W. W. Mertz, Jno. A. Klump.

Batavia, Ill.—Snow Wind Mill Co.; capital, $50,000; to manufacture and deal in wind mills, wind engines, tools, implements, machinery, etc.; incorporators: Franklin L. Chase, W. C. Hawley, Joseph W. Eliel.

Davison, Mich.—Wolverine Carriage Co.; for the manufacture and sale of carriages, carts, wagons, vehicles and parts of vehicles and trimmings for same; incorporators: Enos Parker, A. B. Cullen, I. T. Hurd, Davison, Mich.

Toledo, O.—The Toledo Stove Co.; capital, $100,000; for manufacturing and dealing in stoves, iron-ware, castings, etc.; incorporators: Jacob J. Leonard, Geo. G. Metzger, Theobald Schunck, Harry E. King, Thos. H. Tracy.

Chicago, Ill.—Illinois Electrical Forging Co.; capital, $3,000,000; to manufacture and deal in electrical and other machinery, tools, and furnish light, heat and power to other parties; incorporators: Walter C. Campbell, Jno. P. Skinner, Thos. Cratty.

Chicago, Ill.—Merchants' Ticket Register Co., of Chicago; capital, $15,000; to make, sell and deal in merchants' ticket register, and other office supplies, etc.; incorporators, Hope Reed Cody, J. Monroe Smith, Isaac Lovett.

Milford, Mich.—Wells Cultivator Co.; capital, $50,000; for the manufacture and sale of agricultural implements and other articles, etc.; incorporators: Elizabeth S. Wells, Robt. S. Wells, Arthur C. Wells, all of Detroit, Mich.

Cleveland, O.—The Strong, Carlisle & Turney Co.; capital, $75,000; for manufacturing and dealing in engines, boilers. manufacturers' supplies, etc.; incorporators: E. E. Strong, R. H. Carlisle, W. J. Turney, L. J. Hammond, W. N. Strong.

Chicago, Ill.—Fulton Machine Works; capital, $40,000; to manufacture and deal in general machinery, tools, bicycles and mechanical novelties and appliances; incorporators: A. B. Leith, B. Hampton, A. J. Adams, Alex. Yoeman, E. B. Gehman.

Cincinnati, O.—The Brackett Bridge Co.; capital, $100,000; for building bridges, engineering and superintending work, general iron and steel work, etc.; incorporators: E. J. P. Brackett, F. E. Morris, Glen Wright, R. L. Owens, Jno. W. Herron.

Canandaigua, N. Y.—The Frasse Co.; capital, $100,000; for the manufacture and sale of machinery, tools, etc.; incorporators: H. Frederic Frasse, John T. Pierson, both of East Orange, N. J.; Chas. E. Miller, S. J. Frasse, both of 83 Macon street, Brooklyn, N. Y.

New York City, N. Y.—Campbell & Hill Mfg. Co.; capital, $5,000; for the manufacture and sale of registering and adding machines; incorporators: John B. Campbell, 114 Nassau st.; John G. Hill, 41 Park Row; Elson C. Hill, 41 Park Row, all of New York City, N. Y.

Detroit, Mich.—Detroit Foundry & Machine Co.; capital, $5,000; general foundry and machine business, manufacture and sale of iron and wood articles and combinations of both; incorporators: Edwin W. Abbott, Chas. H. Minckler, Arnold B. Cooper, Detroit, Mich.

Piqua, O.—The Lucas & Barnett Co.; capital, $20,000; for dealing in all kinds of hardware, stoves, plumbers' supplies, tinware, plumbing, slating, galvanized iron and cornice working, etc.; incorporators: W. T. Lucas, L. Leonard, Gilbert

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STORES AND WAREHOUSES AT
Boston, Mass.; New York, N. Y.; Philadelphia, Pa., Cincinnati, O.; Chicago, Ill.; Kansas City, Mo.; San Francisco, Cal.; London, Eng.; Paris, France.

Howell, E. S. Barnett, Geo. A. Brooks, J. G. Schemmel, Chas. H. Pfister.

Chicago, Ill.—Florida Consolidated Phosphate Co.; capital, $100,000; to buy, sell, manufacture and operate machinery and plants for dredging, mining, cleaning and drying phosphate deposits, and prepare same for market; incorporators: Edward Augier, D. R. Peck, Frank B. Kennard.

Grand Rapids, Mich.—Metal Stamping & Spinning Co.; capital, $50,000; to manufacture and sell ornaments and designs in brass, copper, zinc, etc., and general jobbing business in sheet iron and tin, etc.; incorporators: Lars H. Solosth, Harry E. Osgood, Andrew Simons, Grand Rapids, Mich.

New York City, N. Y.—Bates Automatic Elevator & Mfg. Co.; capital, $100,000; to manufacture elevators and appliances for use in buildings and general repairing; incorporators: Henry C. Stetson, 212 W. 44th St., Chas. B. Meserole, 249 W. 44th St., both of New York City, N. Y.; Augustus E. Kissam, 78 Halsey St., Brooklyn, N. Y.

Anderson, Ind.—The Anderson Keg & Package Co.; capital, $15,000; to buy and sell logs, lumber, lumber materials, iron, steel and hardware, to build factories and operate the same, and to manufacture kegs, barrels and any variety of articles chiefly made of wood or iron in any of their forms; incorporators: Frank H. Bowen, Union City, Ind.; James F. Springer, Fortvillle, Ind.; Frank C. Johnson, Anderson, Ind.

New Buyers in the Market, and Some of Their Wants:—

A machine shop has been started at Ashland, Wis., by Wm. M. Beeman and J. Bowman, and an addition is contemplated in the spring.

Joseph Askins, the patentee of the water gas process and the owner of the gas plant destroyed at Greensburg, Pa., recently, is contracting for machinery to reconstruct and enlarge the destroyed plant. He expects to be making gas again within 30 days.

The American Aluminum Co., of St. Louis, Mo., expect to fill orders within the next three or four months. Their buildings will be 100x80 feet and three stories high. They will want an engine of 50 horse-power. At the start ingot aluminum and the alloys will be manufactured.

The Troy Valve Co., of Troy, N. Y., manufacturers of valves and hydrants, expect to have their new plant ready May 1. Buildings are 40x75 feet, three stories high. The company write us that they will purchase bolt and nut machines, crane, derrick, drill, drop press, lathes, pulleys, shafting and portable forges.

The plant of the Sagendorph Iron Roofing & Corrugating Co., Cincinnati, recently destroyed by fire, will be rebuilt as soon as weather permits. There will be two sections, covering a total depth of 204 feet by 60 feet wide. The front section will be three stories high, with a depth of 134 feet, and the rear section two stories high, with a depth of 70 feet.

The Robert S. Sloan-Fitzgibbons Boiler Co., of Oswego, N. Y., has been incorporated by Patrick Fitzgibbons, Robert Sloan, Theodore Irwin, Joseph McGowan and David Fitzgibbons. They will erect a boiler works at Oswego, a building 55 x120 feet, and will equip it with modern machinery and appliances. The Fitzgibbons patent boiler for marine, stationary and locomotive uses, will be manufactured.

The National Car Spring Co., of New York, and the Oswego Railway Spring Co., Limited, of Oswego, N. Y., have consolidated as the National Railway Spring Co. They are to build at Buffalo, N. Y., a plant with machinery and tools of approved type. Meanwhile the present factories of the company at Newark, N. J., and Oswego, N. Y., having a daily capacity of 30 tons of spirals, and 10 tons of elliptics, will fill orders.

Additions, Enlargements, Removals, Etc.:—

North & Judd, of New Britain, Conn., will build a new foundry, 90x50 feet.

The Cream City Woven Wire Works, of Milwaukee, will enlarge their factory and add improvements costing $7,000.

J. Painter & Sons, of Pittsburg, are building a new mill at their West End plant, making the fourth hoop mill.

The P. Wall Mfg. Co. is about completing its new building at Allegheny, Pa., and will add a large number of men to its force.

Massillon, O., Board of Trade has arranged with a concern in Hornellsville, N. Y., manufacturing pulley clutches, to remove to Massillon, O.

The Lexington (Ky.) Foundry Co., capital $50,000, expect to erect extensive additions on two acres of land recently donated by the city of Lexington.

The Canton Steel Roofing Co. are looking for another location. The gas belt has been visited; Pittsburg also claims to have a good chance of being chosen.

Ground has been broken for the new building of the Standard Mfg. Co., at Allegheny, Pa. The present plant is too small to meet the requirements of the company's business.

The Baldwin Locomotive Works, Philadelphia, will be enlarged by the building of a new engine and boiler house and a storage house. The building will be of brick, four stories high and 38x102 feet.

William Tod & Co. are just shipping five machines for draw-

ing shafting to the Union Drawn Steel Co., of Beaver Falls. Messrs. Tod & Co. are adding a new cupola to their foundry, larger than those they have now in use, and are setting up some new tools in their machine shop.—[Youngstown Telegram.

Hartman Bros. & Co., of Beaver Falls, Pa., write to *The Iron Trade Review* that they never heard of the proposed construction of a Western plant by their company, at Joliet, Ill., until they saw details of the project in Joliet and other papers. Yet a man claiming to represent the company has been negotiating with Joliet people for some time past. President Hartman writes: This is probably the same party who successfully worked a similar scheme at Fredericksburg, Va., some three years ago, when he succeeded in getting some money and faring sumptuously at the expense of the good people of that town, and fortunately managed to get away before the swindle was discovered."

Fires and Accidents:—

The Hubbard Saw & Tool Works, Menominee, Mich., were damaged $1,500 worth by fire.

Fire in the pattern rooms of Winslow Bros., ornamental and architectural iron foundry, Carroll avenue and Elizabeth street, Chicago, did $10,000 damage. Many valuable patterns were destroyed.

The upper portion of the building 31-35 Union street, Boston, occupied by the Walker & Pratt Mfg. Co. as a stove and steam heating apparatus manufactory and warerooms, burned Jan. 25, with a large stock of stoves, ranges, furnaces, radiators, etc. Loss $100,000.

At Elwood, Ind., the Macbeth Lamp Flue Works, the largest of the kind in the world, were burned last week. The fire originated from too high natural gas pressure. Over 600 men will be thrown out of employment. The loss is estimated at $100,000; fully insured.

The Milwaukee (Wis.) Gas Stove Co.'s works burned last week, with machinery, patterns and stock. Loss, $25,000; insured.

General Industrial Notes:—

The Warren (O.) Tube Works will be in full operation in a few days, after recent repairs.

Jones & Laughlins, of Pittsburg, are now using coal as fuel almost exclusively, having taken the gas out of nearly all their furnaces.

The repairs to the Bellaire (O.) Nail Works Co. blast furnace will soon be completed. There is talk of another furnace and a new finishing mill.

The Columbus & Hocking Coal & Iron Co. started the Bessie furnace, at New Straitsville, in the Hocking Valley, last week. It had been idle since October.

The employes of the Lookout Iron Co., at Harriman, Tenn., working on an 8-inch mill, with 14 heats, turned out 74,071 pounds of ¾-inch round iron in 9½ hours.

McGill, Wilcox & Co., just incorporated, will manufacture iron and steel, succeeding to the business of McGill & Co., manufacturers of hydraulic machinery, Pittsburg.

At Mt. Savage, Md., the works of the Union Mining Co., manufacturers of the celebrated Mt. Savage fire brick, are running to their full capacity, making 60,000 bricks a day.

The blast furnace partly completed, at Stauffer, Pa., has been purchased by Pittsburg capitalists, who will at once start to complete the same with four other industries which will locate this coming Spring.

Puddle mill No. 3 at the National Tube Works, Pittsburg, is being torn down. A finishing department will be erected on

"Cold Short" on an Old Complaint.

$13.50 for Bessemer pig metal and $21.50 to $21.75 for billets and slabs are prices that are getting disagreeably close to the costs of producing by the best equipped concerns, and they can not go any lower without compelling a very large curtailment of production. It may be probable that, if this is the only medicine that will effect a cure, the sooner it gets in its work the better for all concerned. 9,159,000 gross tons in 1892 is overproduction; production that creates a decided disproportion between the legitimate requirements and the supplies, is excessive, and a production that keeps up an aggregate of 500,000 tons on hand at the end of each year, creates such a disproportion.

If all who hold stocks on hand were able and content to continue holding them for better prices, weakness of prices would not become chronic; but the trouble is few are able to carry stocks of any magnitude, and none of these few want to do so. The rag tag and bob tail of the business, which includes the incompetents and the financially deficient, are perforce anxious to sell; the first don't know enough to know when to urge sales and when to keep quiet, and the last mentioned must realize at the end of one week so as to provide funds for starting the next, and together they harass the markets and obfuscate the ideas of both producers of the better class and consumers—and demoralization becomes the habitual condition—[Ohio Valley Manufacturer.

THE freight rate on coke from Connellsville, Pa., to St. Paul, Minneapolis, Duluth and Superior has been reduced 25c per ton, making the price of coke at these points $4.40.

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the site to work up the product of the steel mill now being erected at McKeesport.

The Wellston Furnace Co., of Wellston, O., expect either to buy or lease the Etna furnace at Ironton, O., and put it in blast after necessary repairs. Hyde, Forsythe & Co. are principal stockholders in the Wellston Furnace Co.

Some of the iron workers belonging to the new Finishers' Union have agreed to go to work at the Elba mill, Pittsburg, where the Amalgamated Association declared a strike some time ago. The mill will be run on steel. No scale has been arranged.

The Youngstown, O., *Vindicator* says that the Quaker Valley Mining Co. is making arrangements to erect a coking plant, expecting to furnish its entire product to Mahoning Valley furnace men, saving them most of the freight they now pay on Connellsville coke.

F. S. Oakes, chairman of the committee on improvements of the Buffalo Real Estate Exchange, reports that a number of manufacturers are corresponding with him for factory sites. He is now negotiating with a machine shop proprietor and a foundry company, both desiring to locate.

Thus one by one they go, victims of the insatiable soft steel. Puddle mill No. 3 at the National tube works is being torn down. A finishing department will be erected on the site to work up the product of the steel mill now being erected at McKeesport. But the probability is that the tearing down operation may be followed by a building up.—[National Labor Tribune.

The Youngstown *Vindicator* says that the old rolling mill at New Castle, burned recently, will be rebuilt. The burned mill was the oldest in Western Pennsylvania, and many pioneer ironworkers employed at the rolling mills at Youngstown learned there the rudiments of iron production.

Geo. T. Bishop, W. A. Sproull and Capt. Chas. M. Swartwood, of Cleveland, visited Sault Ste. Marie last week and were shown the advantages of the proposed site there for a dry dock and ship yard. They said that a meeting of the company in Cleveland within two weeks would act on the matter.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract for rebuilding the tube mill of Curtis & Co., at Cohoes, N. Y., lately destroyed by fire. The new plant will be fire-proof, constructed entirely of iron and brick, no wood-work being used. The building will be 132 feet wide by 131 feet long, with a wing one side 20 feet wide by 74 feet long.

A Philadelphia paper notes the presence in that city of members of a Birmingham, Ala., steel company, en route to Catasauqua, Pa., to confer with Samuel Thomas, relative to the manufacture of Bessemer iron by the shipment of Cuban ores to Pensacola, Fla., and Mobile, Ala., where it will meet the Alabama coke. At Pensacola, the L. & N. has good facilities for handling ore. Pensacola and Mobile are the nearest tide water points to the coal fields of Alabama.

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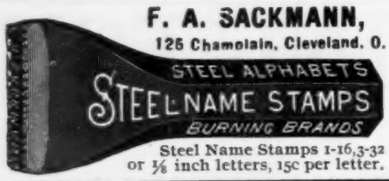

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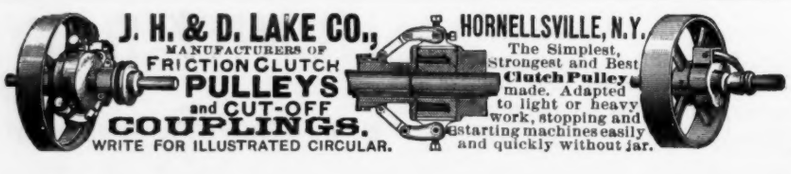

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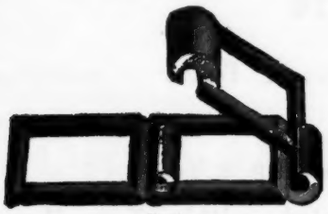

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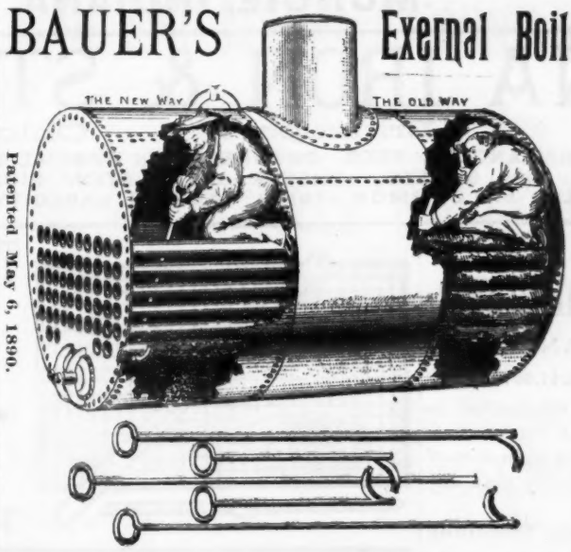

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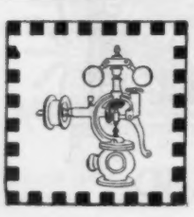

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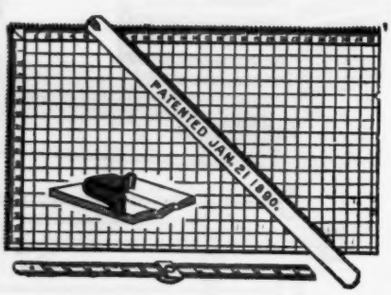

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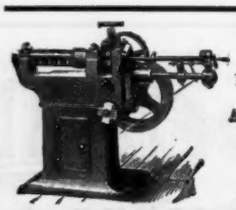

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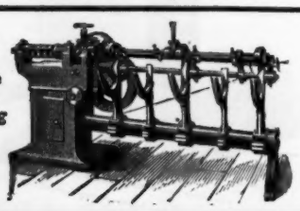

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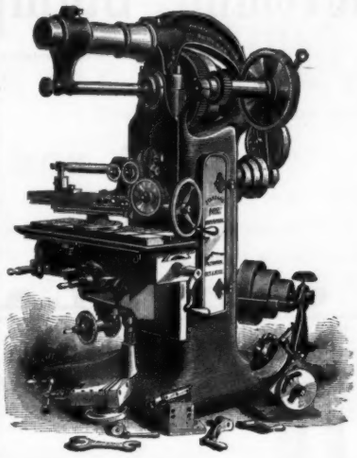

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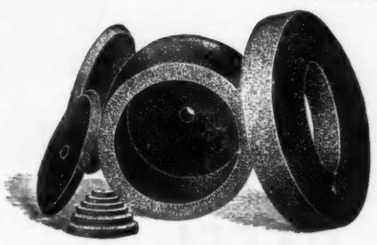

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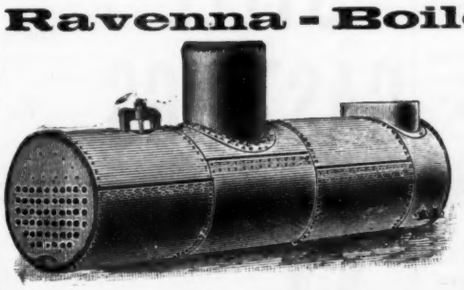

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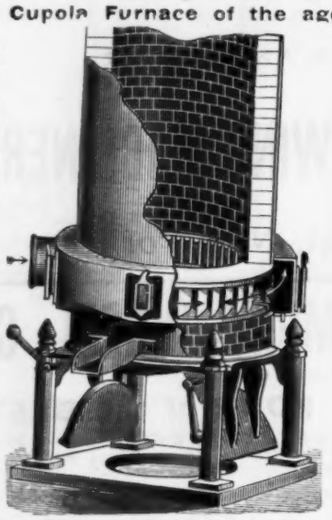

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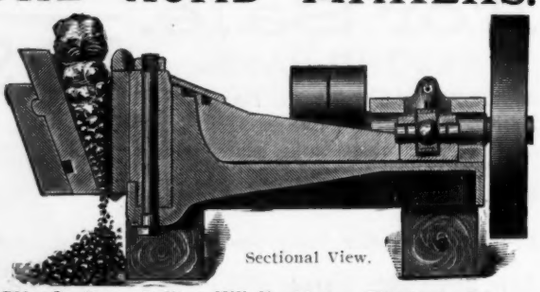

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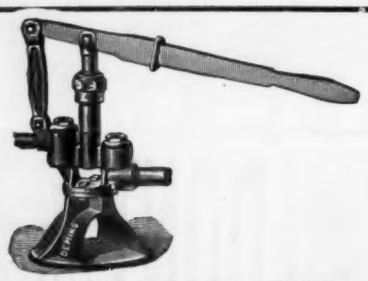

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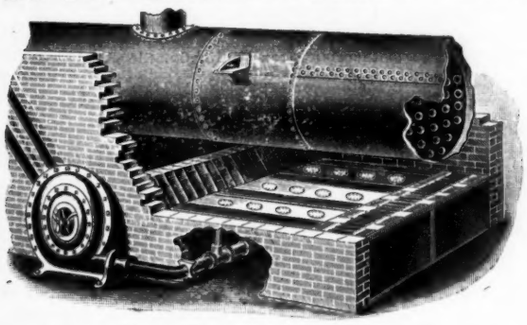

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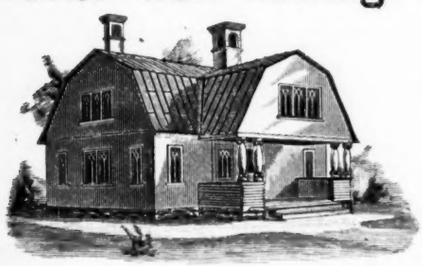

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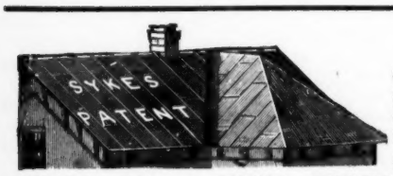

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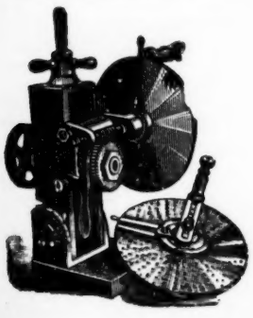

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E. K. Morris & Co., Cincinnati, O.

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Canton Saw Co., Canton, O.

Gearing
Straub Machinery Co., Cincinnati, O.

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Jos. Dixon Crucible Co., Jersey City, N. J.
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Gordon Hollow Blast Grate Co., Greenville, Mich.

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Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.

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Stilwell & Bierce Manufacturing Co., Dayton, O
E. H. Jones & Co., Cleveland.
Warren Webster & Co., Philadelphia, Pa
Brightman Stoker Co., Cleveland, O.

Hack Saws—
Millers Falls Co., New York City.

Hardware Specialties—
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Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

Hangers, Pulleys and Shafting—
Lane & Bodley Co., Cincinnati, O.
The Sam'l C. Tatum Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.

Heating and Ventilating Fans—
B. F. Sturtevant Co., Boston, Mass.

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Kenderdine Hydro-Carbon Fuel Co., Philadelphia, Pa.
C. D. Juvinall & Co., Upper Sandusky, O.

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W. W. Lawrence & Co., Pittsburgh, Pa.

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Weber & Co., Cincinnati, O.

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J. H. Outhwaite & Co., Cleveland.
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Cleveland Iron Mining Co., Cleveland.
Corrigan, Ives & Co., Cleveland.
Aetna Iron & Steel Co., Bridgeport, O.
B. M. Jones & Co., Boston and New York.
Wilhelm & Co., Harrisburg, Pa.

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Eagle Lubricator Co., Cleveland, O.
American Injector Co.

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Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Porter Iron Roofing & Corrugating Co., Cincinnati, O.

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Trenton Iron Co., Trenton, N. J.
Curtis Steel Roofing Co., Niles, O.

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Duluth Mining Investment Co., Duluth, Minn.
Geo. Pemberton, New York.

Insurance Companies—
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Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow & Co., Beaver Falls, Pa.
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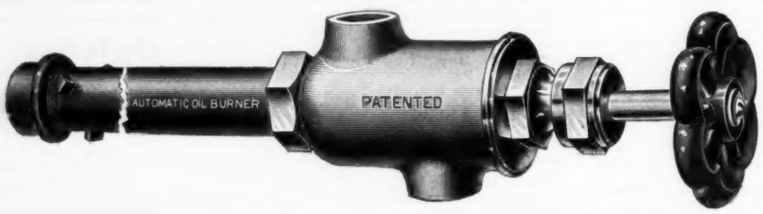

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The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

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Extra Low Phosphorus Bessemer	$ 5.00
No. 1 Specular, Bessemer quality	$4.50
No. 1 Bessemer hematite	$4.00@$4.25
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PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$13 25@$13 40
No. 1 Strong Foundry	14 25@ 14 50
No. 2 Strong Foundry	13 25@ 13 50
No. 1 Grey Forge, red short	12 35@ 12 50
No. 2 Gray Forge, neutral	12 25@ 00 00
No. 1 American Scotch	14 50@ 00 00
No. 2 American Scotch	13 50@ 00 00
Lake Superior Charcoal	17 00

PITTSBURGH (reported by A. H. Childs):

No. 1 Foundry	$14 25@$14 50
No. 2 Foundry	13 25@ 13 50
Grey Forge	12 25@ 12 50
White and Mottled	11 50@ 12 00
Warm Blast Charcoal	18 00@ 22 00
Cold Blast Charcoal	22 00@ 27 00
Bessemer	13 20@ 13 40

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$16 50@$17 00
Local Coke Foundry No. 1	13 75@ 14 00
Local Coke Foundry No. 2	13 25@ 13 50
Local Coke Foundry No. 3	13 00@ 13 25
Local Scotch Foundry No. 1	14 00@ 14 50
Local Scotch Foundry No. 2	13 50@ 14 00
Local Scotch Foundry No. 3	13 00@ 13 50
Southern Coke No. 1	14 85@ 15 00
Southern Coke No. 2	13 60@ 14 00
Southern Coke No. 3	13 00@ 13 25
Southern No. 1 Soft	13 60@ 14 00
Southern No. 2 Soft	13 00@ 13 25
Ohio Silveries No. 1	16 50@ 17 00
Ohio Silveries No. 2	16 25@ 16 75
Ohio Strong Softeners No. 1	16 50@ 17 00
Ohio Strong Softeners No. 2	15 50@ 16 00
Tennessee Charcoal	16 50@ 17 00
Alabama Car Wheel	18 35@ 19 85

CINCINNATI (reported by Hyatt, Mathews & Co.):

Southern Coke No. 1, Foundry	$13 50@$14 00
Southern Coke No. 2 and No. 1 Soft	12 25@ 12 75
Southern Coke No. 3	12 25@ 12 50
Ohio Soft Stone Coal No. 1	16 00@ 16 50
Mahoning Valley No. 1	16 00@ 16 25
Mahoning Valley No. 2	15 00@ 15 25
Hanging Rock Charcoal No. 1, Fdy	18 50@ 19 50
Hanging Rock Charcoal No. 2, Fdy	17 50@ 18 00
Alabama Charcoal No. 1	15 50@ 16 00
Standard Southern Coke, Grey Forge	11 25@ 11 75
Mottled Neutral Coke	12 00@ 12 25
High Grade Virginia Coke Iron No. 1	16 25@ 16 50
High Grade Virginia Coke Iron No. 2	15 25@ 15 50
Southern Car Wheel Iron	18 00@ 18 75
Lake Superior Car Wheel & Malleable	17 50@ 18 00

BUFFALO (reported by Rogers, Brown & Co.)

Mahoning and Shenango Valley, strong, No. 1 Foundry	$15 00
Mahoning and Shenango Valley, strong, No. 2 Foundry	14 00
Ohio Softener No. 1	15 00
Ohio Softener No. 2	14 00
Jackson Co. Silvery, No. 1	$17 00@ 17 30
Jackson Co. Silvery, No. 2	16 30@ 16 80
Lake Superior Charcoal	17 25
Tennessee Charcoal	18 00
Southern Softener No. 1	14 50@ 14 40
Alabama Car Wheel	19 00
Hanging Rock Charcoal	20 50

LOUISVILLE (reported by Geo. H. Hull & Co.)

Southern Coke No. 1 Foundry	$13 25@$13 50
Southern Coke No. 2 Foundry	12 00@ 12 25
Southern Coke No. 3 Foundry	11 50@ 11 75
Grey Forge	11 25@ 11 50
Southern Charcoal No. 1 Foundry	15 00@ 16 00
Car Wheel	17 50@ 17 75

LOUISVILLE (reported by Hall Bros. & Co.):

Southern Coke No. 1	$13 50@$13 75
Southern Coke No. 2	12 50@ 12 75
Southern Coke No. 3	12 00@ 12 25
Southern Charcoal No. 1	16 00@ 17 00
Southern Charcoal No. 2	15 50@ 16 00
Missouri Charcoal No. 1	17 00@ 17 50
Missouri Charcoal No. 2	16 50@ 17 00
Neutral Coke	11 50@ 12 00
Cold Short	11 25@ 11 50
Mottled	11 00@ 11 25
Southern (standard brands)	20 00@ 21 00
Southern (other brands)	18 50@ 19 50
Lake Superior	19 50@ 20 50

ST. LOUIS (reported by Rogers, Brown & Meacham):

Southern Coke No 1	$14 25@$14 50
Southern Coke No. 2	13 00@ 13 25
Southern Coke No. 3	12 75@ 13 00
Southern Grey Forge	12 00@ 12 25
Southern Charcoal No. 1	16 00@ 16 50
Southern Charcoal No. 2	15 00@ 15 50

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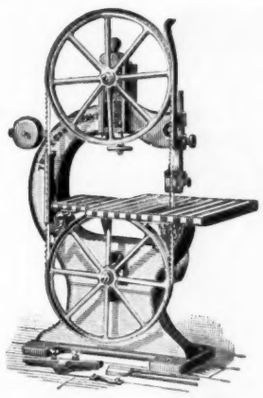

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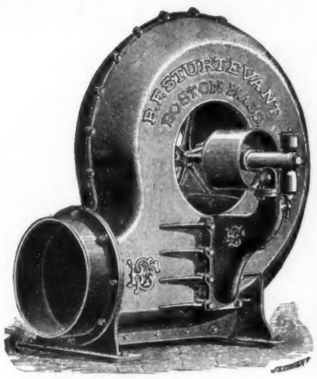

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THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

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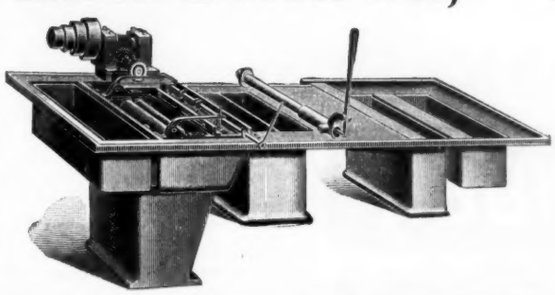
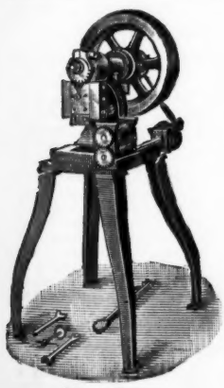


Rolling Mills, Sand and Chill ROLLS.



No. 25 Press.

THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

Presses, Dies and Special Machinery,

FOR BAR AND SHEET METALS. DIES FOR ALL KINDS OF WORK.

Mention this paper. SEND FOR ILLUSTRATED CIRCULARS.

Oak and Superior Sts., TOLEDO, OHIO.

Missouri Charcoal No. 1	14 50@	15 00
Missouri Charcoal No. 2	14 00@	14 50
Ohio Softeners	16 50@	17 00
Lake Superior	18 00@	18 25
Southern	18 50@	18 75
Connellsville Coke, St. Louis		5 65

DETROIT (reported by William F. Jarvis & Co.):

Lake Superior Charcoal, all numbers	$16 50@	$17 00
Lake Superior (coke) Bessemer	15 00@	15 50
Lake Superior Coke, Foundry, all ore	16 25@	16 75
Standard Ohio Black Band	16 00@	16 50
Southern No. 1	14 50@	15 00
Southern Grey Forge	12 50@	13 00
Jackson County (Ohio) Silvery	17 50@	18 00

OLD RAILS AND SCRAP METAL.

	Gross Tons
Old iron rails	$19 00
Old steel rails	14 50
	Net Tons
No. 1 R. R. wrought scrap	$15 50
No. 1 wrought scrap	14 50
No. 1 Machine cast scrap	11 00
Iron axles	20 50
Axle turnings	12 00
Wrought turnings (free from cast)	9 50
Cast borings	6 75
Uncut wrought iron boilers	9 00
Steel boiler Plates	12 00
Grate bars	7 00
Pipes and flues (clean)	10 00
Tank iron	10 00
Hoop and band iron	8 00
Sheet iron	7 00
Wrought drillings	8 50
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.90c@2.00c
Angles	1.70c@1.80c
Tees	2.30c
Universal Plates	1.70c
Sheared Plates	1.80c

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 65
1¼ to 6 by ⅜ to 1 inch	1 70
1¾ to 6 by 1⅛ to 2 inch	1 85
1¼ & 1⅜ by ⅜ to ¾ inch	1 70
1 & 1⅛ by ⅜ to ¾ inch	1 75
⅝, ¾, ⅞, by ⅜ to ⅝ inch	1 85

Round and Square.

1 to 1⅞ inch	1 65
2 to 2⅝ inch	1 75
2¾ to 3¼ inch	1 90
3⅜ to 4 inch	2 15
4¼ to 4½ inch	2 75
4¾ to 5 inch	3 00

Oval.

⅞ to 1¼ inch	1 85
⅝ to ¾ inch	1 85
½	2 05
⅜	2 25

Half Oval and Half Round.

1½ to 3 inch	2 20
⅞ to 1½ inch	2 00
⅝ to ¾ inch	2 25
½	2 40
⅜	3 50

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 75
1 to 1⅜ by ¼ and 5-16 inch	1 80
¾ to ⅞ by ¼ and 5-16 inch	1 90
½ to ⅝ by ¼ and 5-16 inch	2 15

Hoops.

1¾ to 4, Nos. 13 to 15	2 40
1¼ to 2, Nos. 16 to 18	2 45
1¼ to 2. No. 19	2 50
1¼ to 2, No. 20	2 50
1¼ to 2, No. 21	2 60
1¼ to 2, No. 22	2 70
15-16, 1 and 1⅛, Nos. 13 to 15	2 45
15-16, 1 and 1⅛, Nos. 16 to 18	2 50
15-16, 1 and 1⅛, Nos, 19 and 20	2 60
15-16, 1 and 1⅛, No, 21	2 70
15-16, 1 and 1⅛, No. 22	2 80
⅞, Nos. 13 to 15	2 60
⅞, Nos. 16 to 18	2 70
⅞, Nos. 19 and 20	2 80
⅞, No. 21	2 90
⅞, No. 22	3 00
13-16, Nos. 13 to 15	2 70
13-16, Nos. 16 to 18	2 80
13-16, Nos. 19 and 20	2 90
13-16 No. 21	3 00
13-16, No. 22	3 10
¾, Nos, 13 to 15	2 80
¾, Nos. 16 to 18	2 95
¾, Nos. 19 and 20	3 05
¾, No. 21	3 15
¾, No. 22	3 25
11-16, Nos. 13 to 15	3 05
11-16, Nos 16 to 18	3 10
11-16, Nos. 19 and 22	3 20
11-16, No. 21	3 30
11-16, No. 22	3 40
⅝, Nos. 13 to 15	3 10
⅝, Nos. 16 to 18	3 20
⅝, Nos. 19 and 20	3 30
⅝, No. 21	3 40
⅝, No. 22	3 50
⅝, No. 23	3 60

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 95
1½ to 6 by Nos. 11 and 12	2 00
1 to 1⅜ by ⅛ to 3-16 inch	2 00
1 to 1⅜ by Nos. 11 and 12	2 05
⅞ and 13-16 by ⅛ to 3-16 inch	2 15
⅞ and 13-16 by Nos. 11 and 12	2 20

OFFICE : 510---265 to 269 DEARBORN ST.
WORKS AT SOUTH CHICAGO.

TUBULAR LANTERNS,
WATCHMAN'S LANTERNS,
OIL CANS,
BENZINE CANS,
PERFECTION VALVE OILERS,
TORCHES.

RAU MANUFACTURING CO.,
235 Lake St., CHICAGO, ILL.

Fine Office Desks
OF ALL KINDS AND PRICES.
DOCUMENT AND LETTER FILES,
LIBRARY AND OFFICE CHAIRS.
Metal Vault Work For Banks and Offices.

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THE CLEVELAND DESK COMPANY, 97 AND 99 ONTARIO ST.,
CLEVELAND, O.

HERCULES POWDER

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE
Known to the Arts.
POWDER, FUSE, CAPS,
Electric Mining Goods,
AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
L. W. WILLARD, Manager.

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

¾ and 11-16 by ⅛ to 3-16 inch	2 25
¾ and 11-16 by Nos. 11 and 12	2 30
⅝ and 9-16 by ⅛ to 3-16 inch	2 40
⅝ and 9-16 by Nos. 11 and 12	2 45
½ by ⅜ to 3-16 inch	2 55
¼ by Nos. 11 and 12	2 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 20
⅞ inch, " " " " 13 and 14	2 30
¾ inch, " " " " 11 and 12	2 35
¾ inch, " " " " 13 and 14	2 55

Sheet Iron.

No. 10 to 14	2 30
No. 15 to 17	2 45
No. 18 to 21	2 60
No. 22 to 24	2 70
No. 25 to 26	2 80
No. 27	2 90
No. 28	3 55

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1, " "	2 50
C H Flange, " "	3 50
Extra Flange "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ℔. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 116 in. wide,	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s.
1 to 2 in, inclusive	08
9-16 to ½ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in	09
3⅛ to 4 in	09½
⅝ to 11-16 and 4½	10
⅛ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
3-16 in	13

Flats.

	cts. ℔s.
2 to 9-16 in. wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery	base price, 2 35
Tire	" 2 25
Spring	" 2 80
Sleigh Shoe	" 2 50
Toe Calk	" 2 35
Cutter Shoes, tapered and bent	" 2 75

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 45
Munson's Short Lap Double and Light Double Leather	dis 50
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 30
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 35

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15

EXCELS IN 5 ESSENTIALS.

Th New Griffin Mill excels all other pulverizers, especially in these five vital qualifications.

Note the Claims! Read the Testimony!

1st. It does double work with same horse power.

"We pulverize over 20 tons of tough, hard material per day, through 180 mesh wire, using only about 16 horse power." OHIO METALLIC PAINT CO.

2d. It is economical and needs few repairs.

"Its small wear is phenomenal; far below that of any other mill in the market." G. H. NICHOLS & CO.

3d. Its output is enormous.

"We are pulverizing 46½ tons of sun-dried rock through a fine screen every ten hours." WAPPOO MILLS.

4th. It grinds evenly with direct delivery and without tailings.

"It requires little or no attention, goes right along, does its work and does it nicely." ALEXANDRIA FERTILIZER AND CHEMICAL CO.

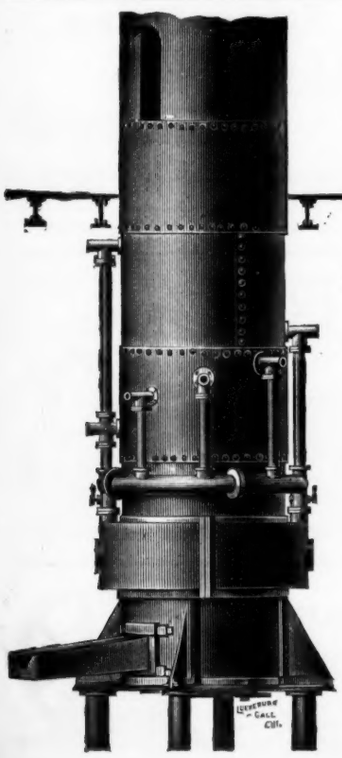
5th. They are substantially built and withstand hard usage.

"The two mills have been in constant use for two years and continue to give us entire satisfaction." LOUIS F. DETRICK & SON.

Intending purchasers of pulverizing apparatus are invited to correspond with us and secure full detailed information regarding these Mills before placing their order.

BRADLEY FERTILIZER CO.
92 STATE STREET, BOSTON.

BEING IN THE BOILER BUSINESS.
MAKING STATIONARY TUBULAR BOILERS EXCLUSIVELY.
WE CAN MAKE A BETTER BOILER AND ALTHOUGH WE MAKE THEM OF
FLANGE STEEL WITH WELDLESS BRACES AND ECLIPSE MANHOLES
SELL THEM FOR LESS MONEY THAN OLD STYLE ONES.
WE FURNISH NEATER LITHOGRAPHS AND DETAIL ILLUSTRATIONS OF THIS CLASS OF BOILER THAN ANY FIRM IN THE UNITED STATES.
FULTON STEAM BOILER WORKS AND FOUNDRY. RICHMOND, IND.



THE
GREINER
Patent Economical
CUPOLA.

10 to 50 Per Cent. Saving in Fuel,
With Corresponding Increase in Quality of Iron Melted, Over any Existing Cupola.
15 Per Cent Saving Guaranteed.

Can be Applied to any Type of Cupola Now in Use.

400 IN USE IN EUROPE.
U. S. REFERENCES GIVEN.

AGENTS WANTED.

The Greiner Economical Cupola Co.,
714 Bort Building,
CHICAGO.

Morse.....dis 15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 3½
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist Drills.....dis 50&10
Morse Taper and Straight Shank to 1½".dis 50&10
Morse Taper and Straight Shank Larger than 1½".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, C. F. F. FF.
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans, less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 50@50&5
H. H. Barton.....dis 50@50&5

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 60&10
Hamden.....dis 60&10
Cyclone.....dis 60

Files.

Arcade.....dis 60&10@60&10&10
Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
McClellan.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works, Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs.....15c
" " " " over 5 lbs.....12c

Jack Screws.

Illinois Bolt Co. list.....dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¾	3⅛
Hexagon	15½	11½	8½	6	5¾	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887.....dis 75
Standard Penny Nails, ₩ keg card rate
Car lots.....$1.50
Less than car lots...$1.60

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 9@10
Russia " " .....₩ lb 14
Italian " " .....₩ lb 13@19
Plumbago Piston.....₩ lb 40
Peerless.....₩ lb 60
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48
Rainbow.....Full Rolls.....50c ₩ lb
Less than Full Rolls. 60c ₩ lb
Eclipse Gasket.....₩ lb 75

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 40
Medart Pulleys.....dis 50
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17.....dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50@50&10
Copper.....dis 50@50&10

Saws.

Disston's Circular.....dis 40&10
" Band.....dis 25
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Diston's.....dis 30
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws.....dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....70c per ft
" Dexter Cross-cuts.....50c "
" Diamond " .....30c "
" Tuttle Tooth Cross-cuts.....25c "
" One-man Cross-cuts.....32c "

No. 1 Handles	23c per pair
No. 6 " "	16c "
Excelsior Saw Tools	$6 per doz
Perfection "	$15 "
Detroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Jan. 18, 1884

Brass	dis 30
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ₱ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

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THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

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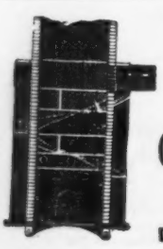

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Sole Manufacturer of the

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COLLIAU CUPOLA.

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STEEL, IRON, COPPER, ZINC, BRASS, TIN,

And all Other Metals Perforatedias Required for

GRAIN CLEANING AND MINING MACHINERY,
WOOLEN, COTTON, PAPER AND PULP MILLS,
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SUGAR AND MALT HOUSES, DISTILLERIES, FILTER PRESSES,
STONE, COAL AND ORE SCREENS,
BRICK AND TILE WORKS, FILTERS,
SPARK ARRESTERS, GAS AND WATER WORKS,
OIL, GAS AND VAPOR STOVES,
COFFEE MACHINERY, ETC., ETC.

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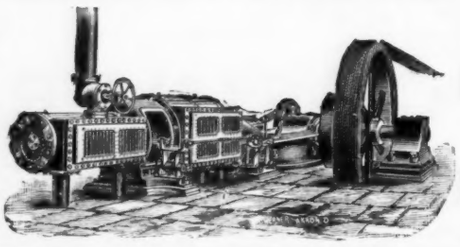
Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING



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Heavy Special Machinery.

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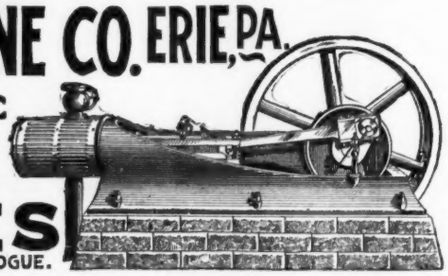
SKINNER ENGINE CO. ERIE, PA.

Center or Side CRANK Automatic or Throttling

ENGINES



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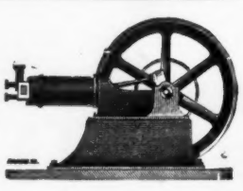
POWER From **GAS OR GASOLINE.**

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 100 horse-power. } Can be Used in City or Country.

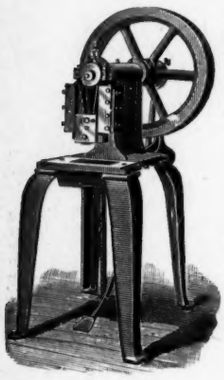
In conjuction with our Producer Gas Apparatus, we guarantee coal consumption of 1½ pounds per hour per h.p.

OTTO GAS ENGINE WORKS., 33rd & Walnut Sts. PHILADELPHIA, PA



GODFREY J. BREMER,

MANUFACTURER OF



Hand and Power Punching and Shearing Presses, Dies and Special Machinery for Bar and Sheet Metals, Etc., Etc.

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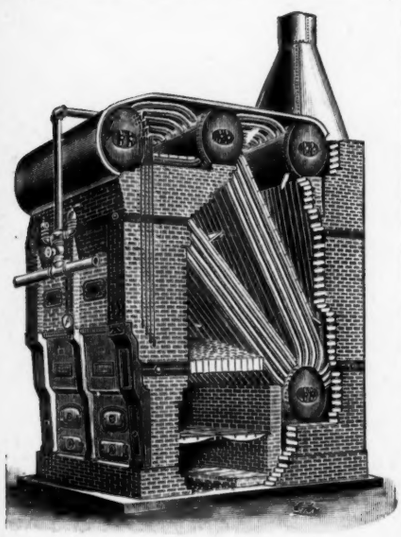
THE STIRLING BOILER



Is economical in fuel and repairs, practically self-cleaning. 4 manholes give access to every tube. It will pay you to investigate before purchasing elsewhere. - -

THE STIRLING COMPANY,

General Office, Pullman Bldg., Chicago.

Cleveland Office, 32 Lake St.

JAS V. BURKE,

62 Gaff Building, 236 LaSalle St., Chicago.

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